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Kitamura et al.

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(54) **IMAGE FORMING APPARATUS CAPABLE OF MOVING BELT UNIT TOGETHER WITH SUPPORT MEMBER**

(71) Applicant: **Brother Kogyo Kabushiki Kaisha**, Nagoya-shi, Aichi-ken (JP)

(72) Inventors: **Yukiko Kitamura**, Nagoya (JP); **Takashi Arakawa**, Nagoya (JP); **Shougo Sato**, Seto (JP)

(73) Assignee: **Brother Kogyo Kabushiki Kaisha**, Nagoya-shi, Aichi-ken (JP)

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G03G 21/18 (2006.01)

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CPC ***G03G 21/1638*** (2013.01); ***G03G 21/1671*** (2013.01); ***G03G 21/1853*** (2013.01); *G03G 2221/1684* (2013.01)

(58) **Field of Classification Search**
USPC 399/107, 110, 116, 117, 297–299, 302, 399/303, 308
See application file for complete search history.

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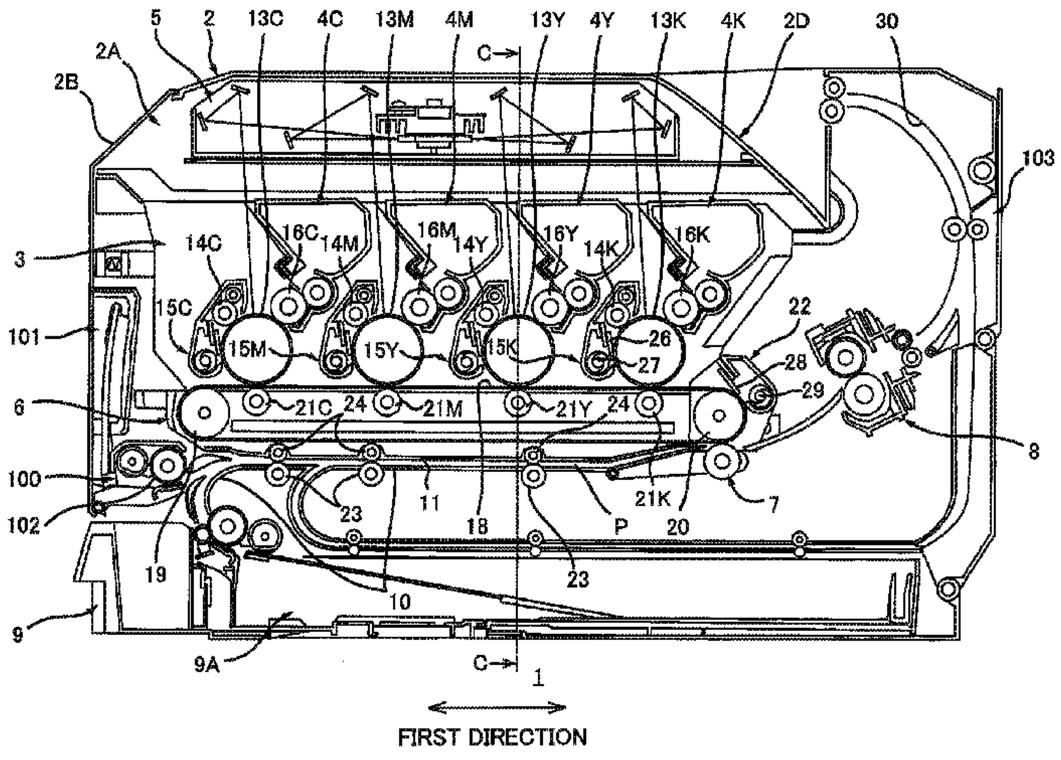
Primary Examiner — Hoan Tran
(74) *Attorney, Agent, or Firm* — Banner & Witcoff, Ltd.

(57) **ABSTRACT**

An image forming apparatus includes: a main body casing; a photosensitive drum; a support member; a belt unit; a transfer roller; and a second sheet guide. The support member is movable between a first accommodated position and a first withdrawn position. The belt unit is movable between a second accommodated position and a second withdrawn position. The belt unit includes: a first sheet guide; and a transfer belt. The belt unit is movable together with the support member. The second sheet guide is positioned below the belt unit and faces the first sheet guide to define a sheet conveying path between the first sheet guide and the second sheet guide in a state where the belt unit is at the second accommodated position. The second sheet guide is configured to convey a sheet along the sheet conveying path toward a position between the transfer belt and the transfer roller.

20 Claims, 12 Drawing Sheets



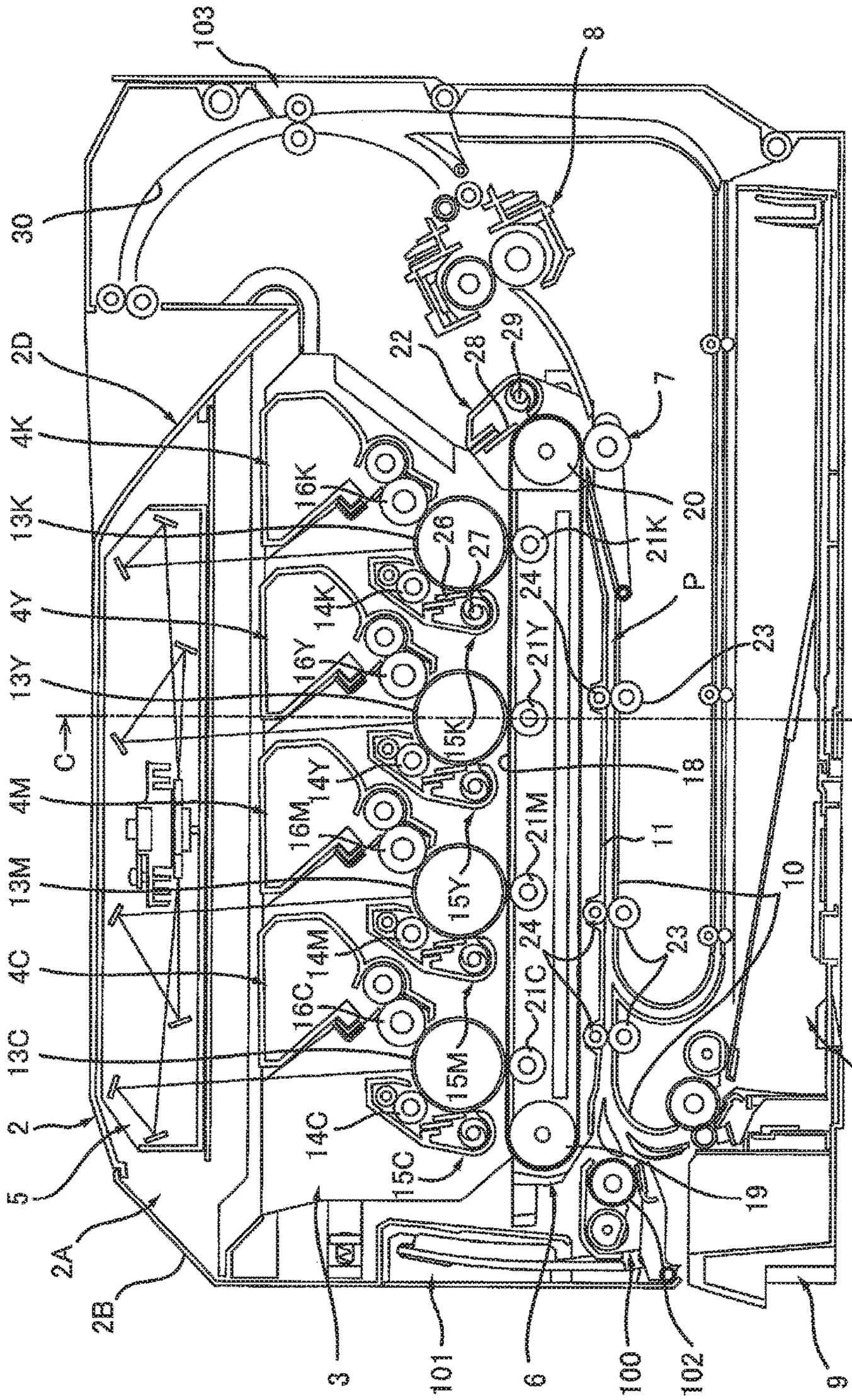

103
8
30
2D
4K
13K
4Y
13Y
4M
13M
4C
13C
2
5
2A
2B
C
1
FIRST DIRECTION
22
28
29
7
16K
26
27
14K
16Y
15K
14Y
16M
15Y
14M
16C
15M
14C
15C
21K
20
P
24
21Y
23
18
11
21M
21C
10
19
9A
3
101
6
100
102
9

FIG. 1

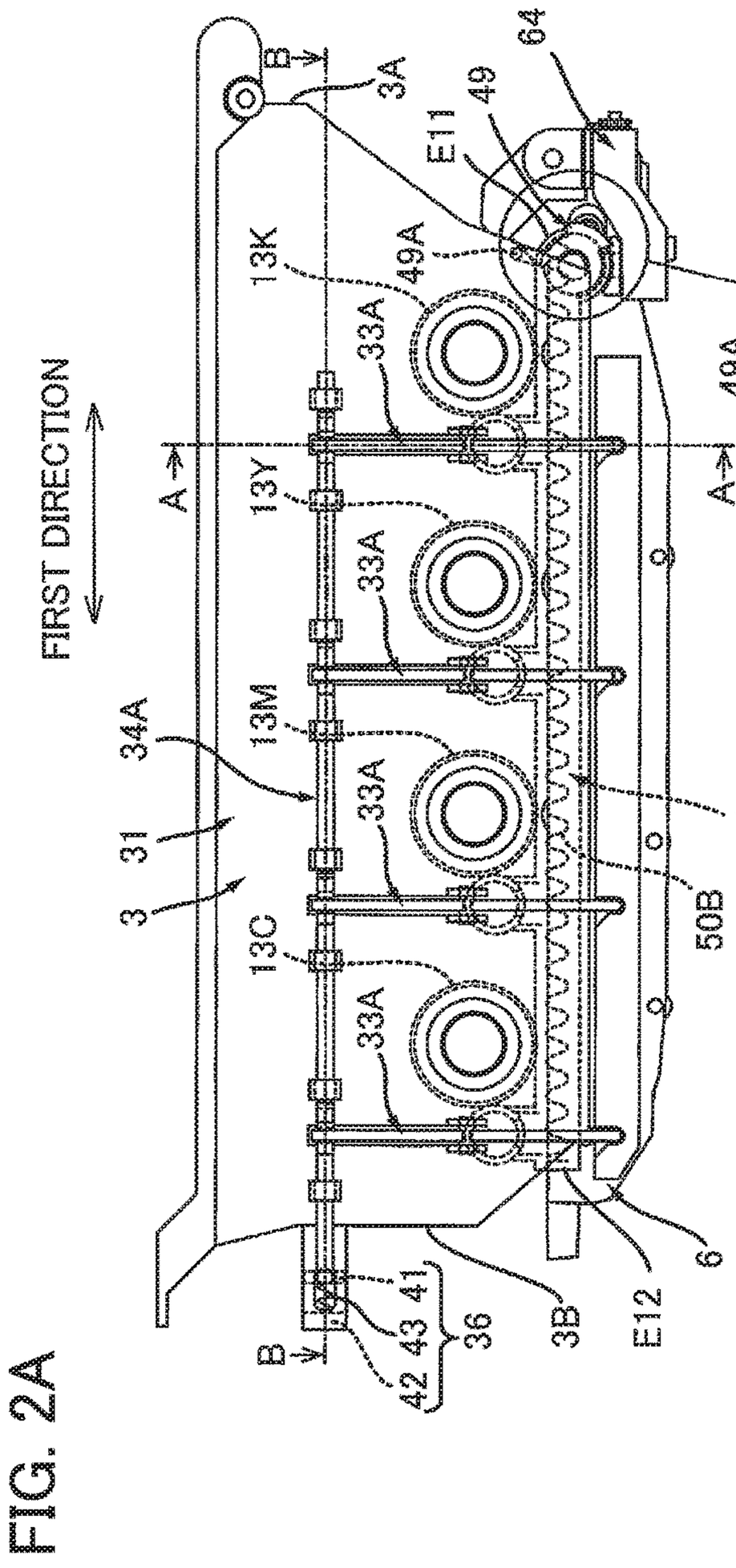


FIG. 2A

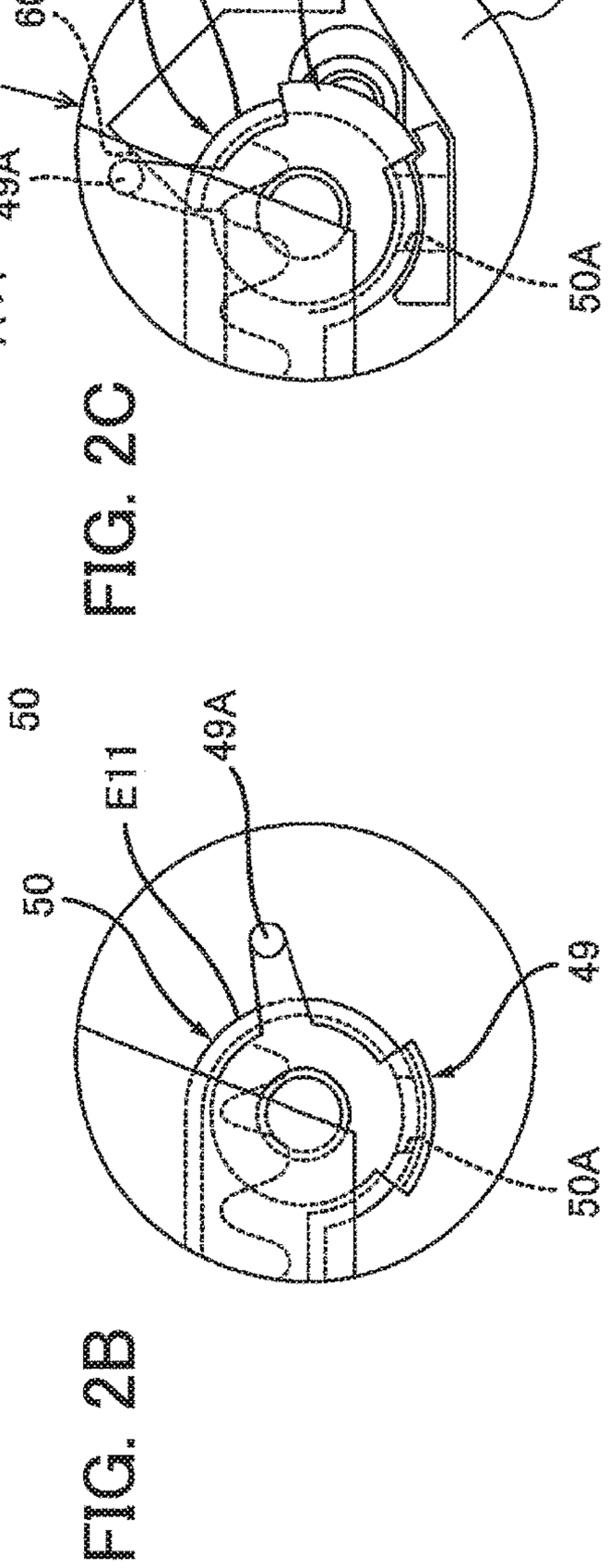


FIG. 2C

FIG. 2B

FIG. 3A

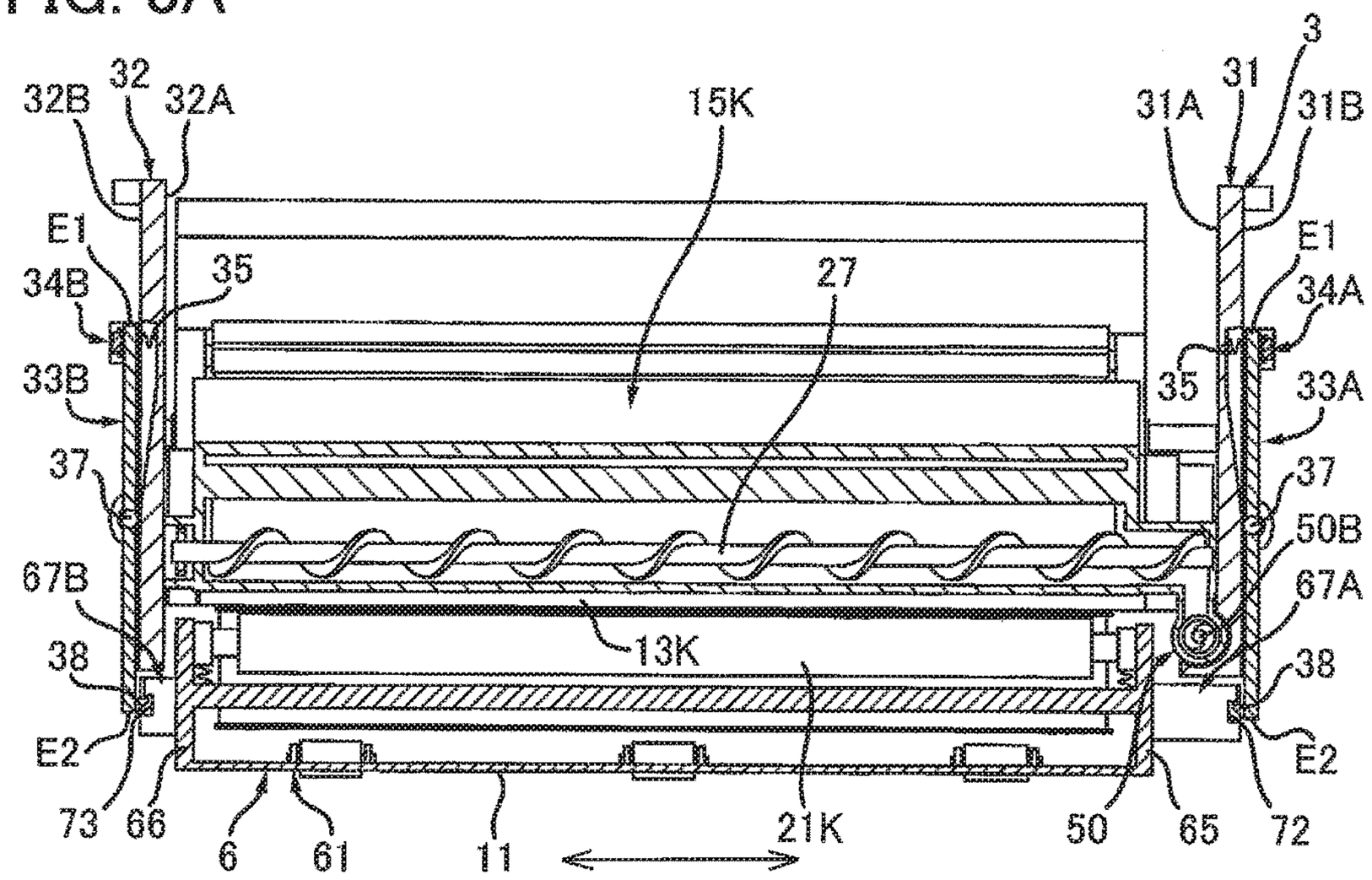
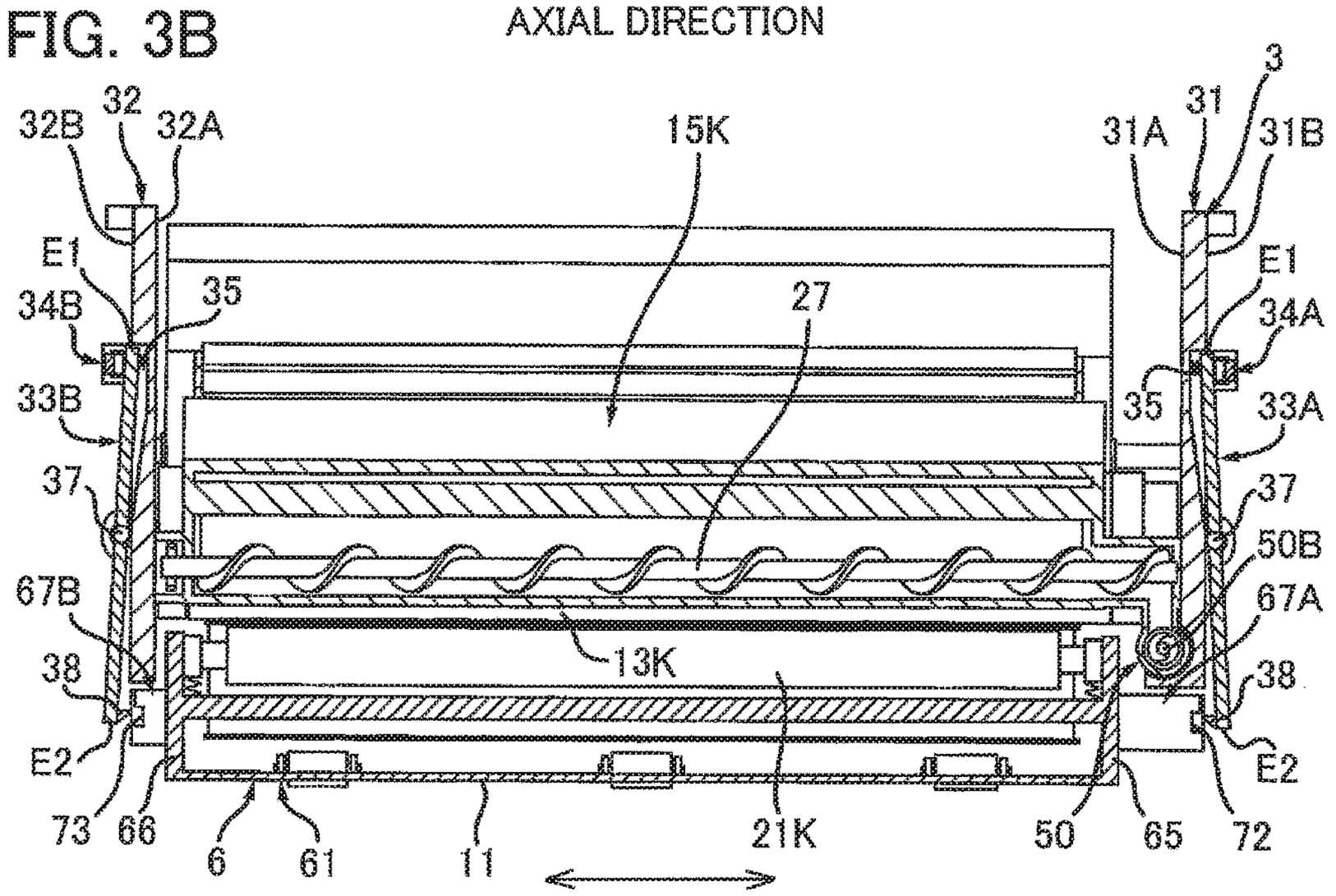

32B
32
32A
15K
3
31
31A
31B
E1
35
27
34B
34A
33B
33A
37
50B
67B
67A
13K
38
E2
73
66
6
61
11
21K
50
65
72
AXIAL DIRECTION

FIG. 3B


32B
32
32A
15K
3
31
31A
31B
E1
35
27
34B
34A
33B
33A
37
50B
67B
67A
13K
38
E2
73
66
6
61
11
21K
50
65
72
AXIAL DIRECTION

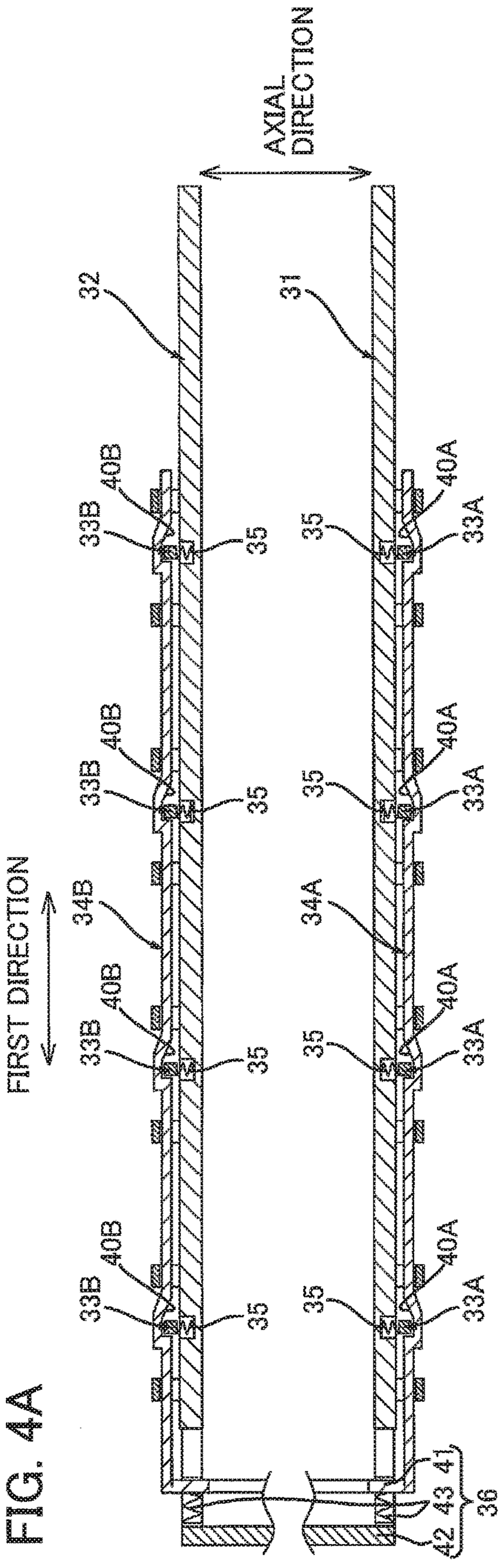

AXIAL DIRECTION
32
31
33B
40B
35
34B
34A
40A
33A
FIRST DIRECTION
42 43 41
36

FIG. 4A

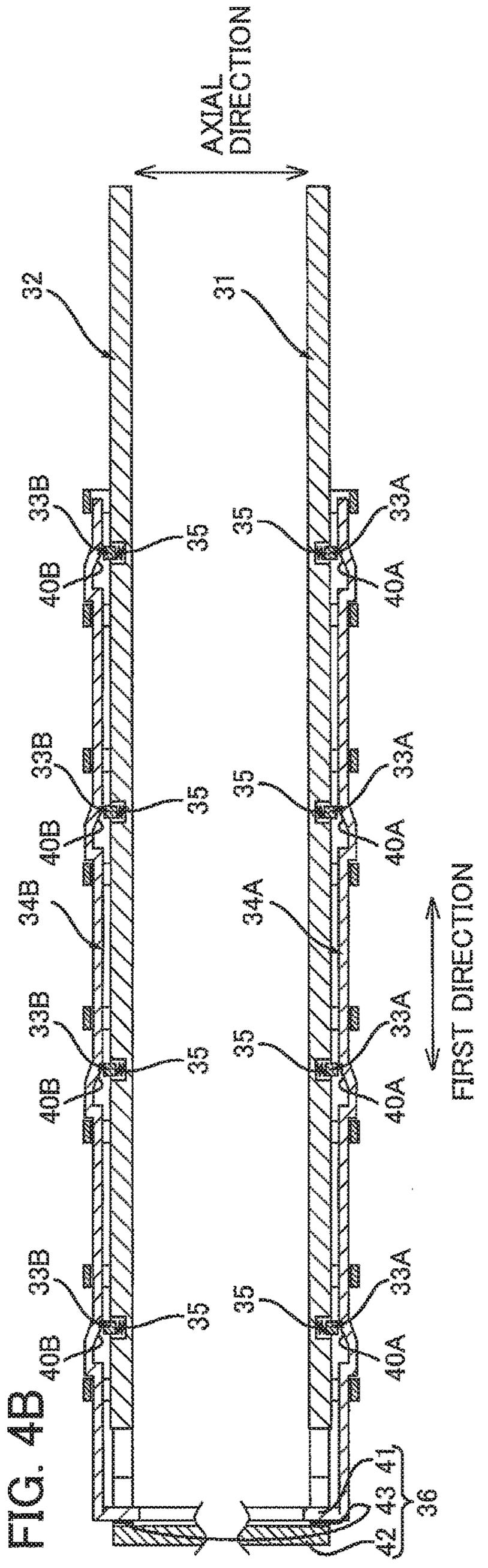

AXIAL DIRECTION
32
31
33B
40B
35
34B
34A
40A
33A
FIRST DIRECTION
42 43 41
36

FIG. 4B

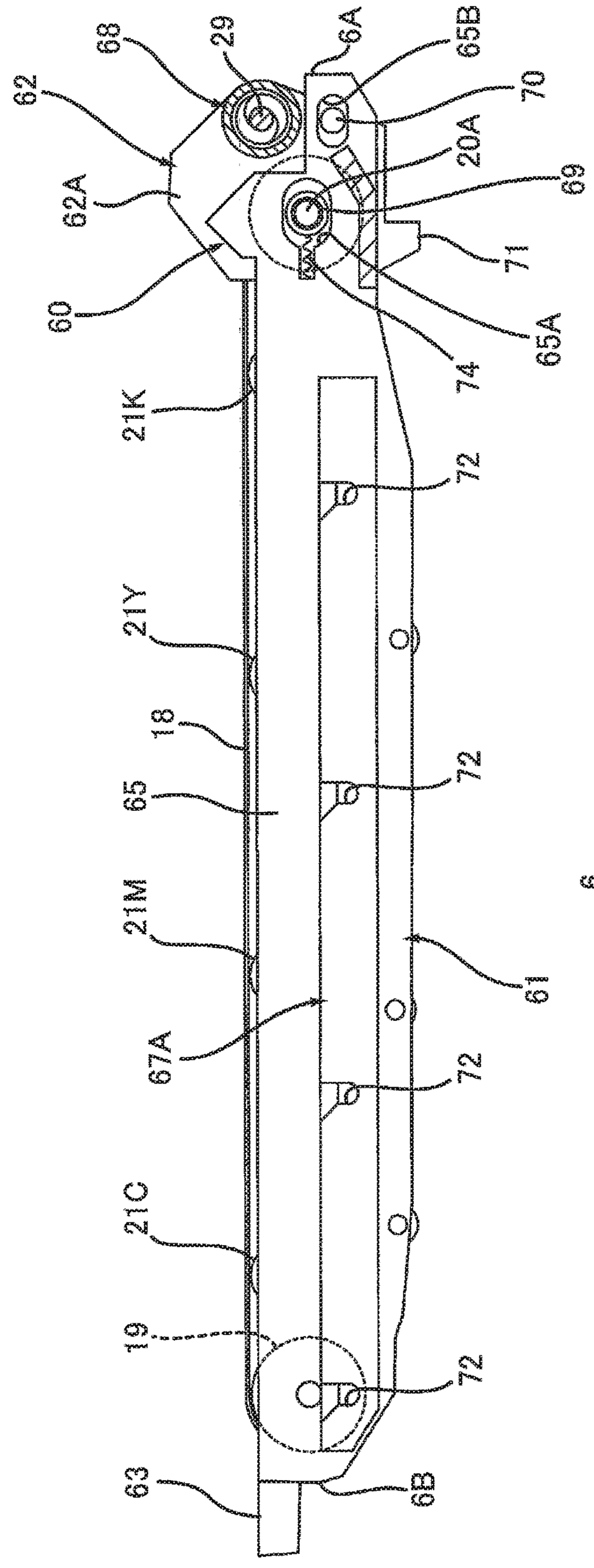

68
29
6A
65B
62
70
20A
62A
69
71
60
65A
74
21K
72
21Y
18
65
72
21M
61
67A
72
21C
19
72
63
6B
FIRST DIRECTION
6

FIG. 5

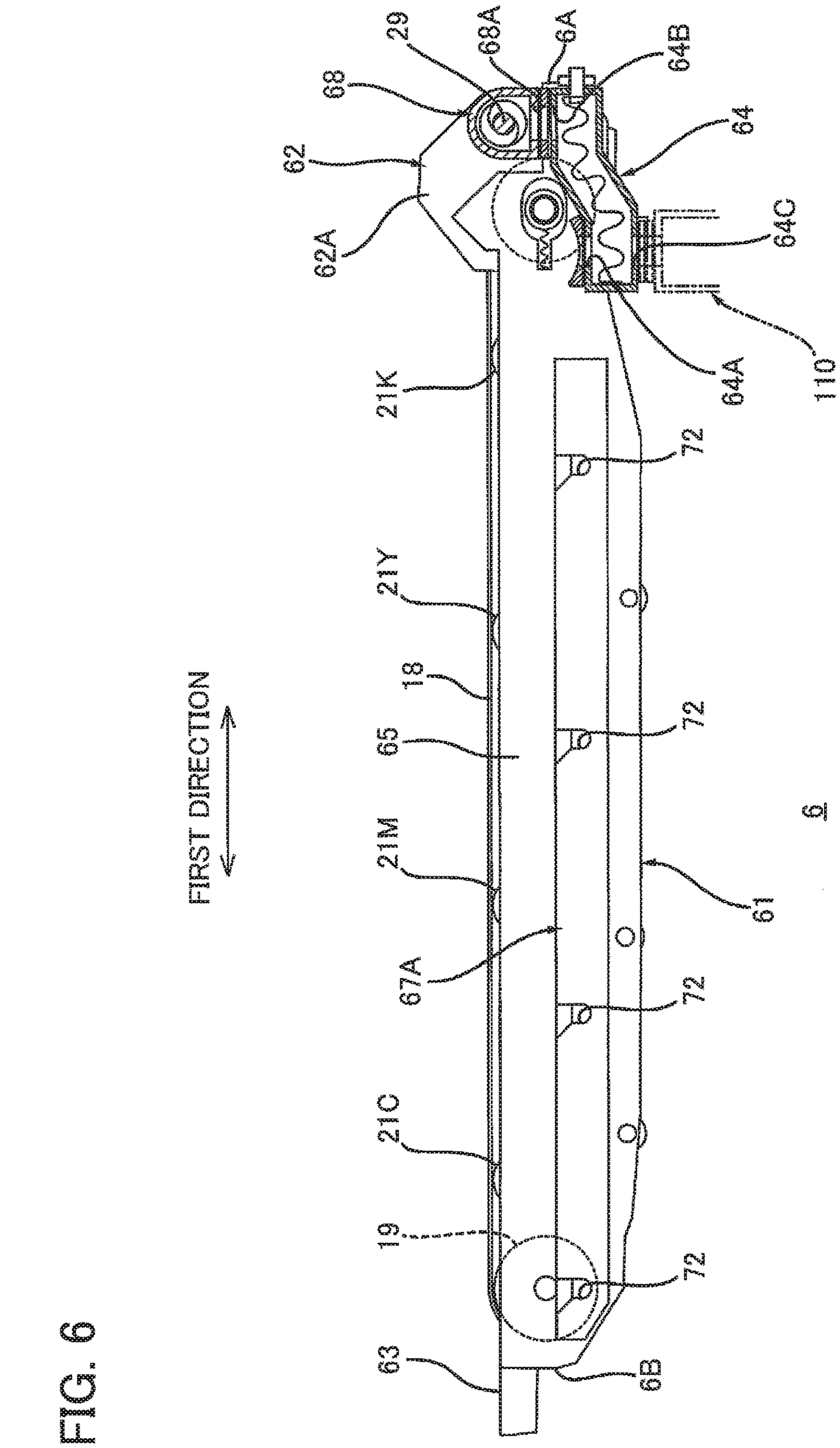

29
68A
6A
64B
68
64
62
64C
62A
64A
110
21K
72
21Y
18
65
72
21M
72
61
67A
72
21O
19
72
63
6B
FIRST DIRECTION
6

FIG. 6

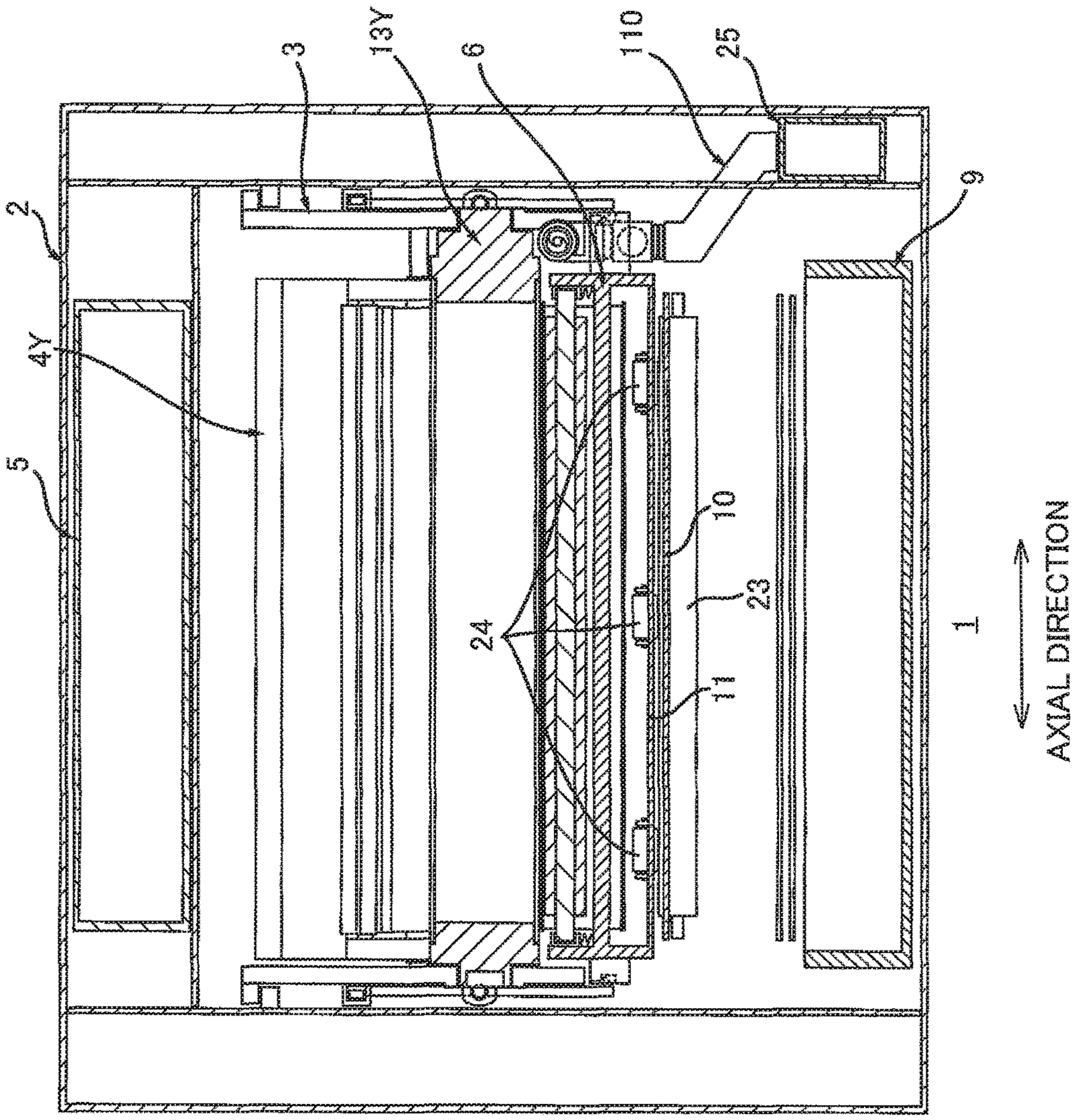


FIG. 7

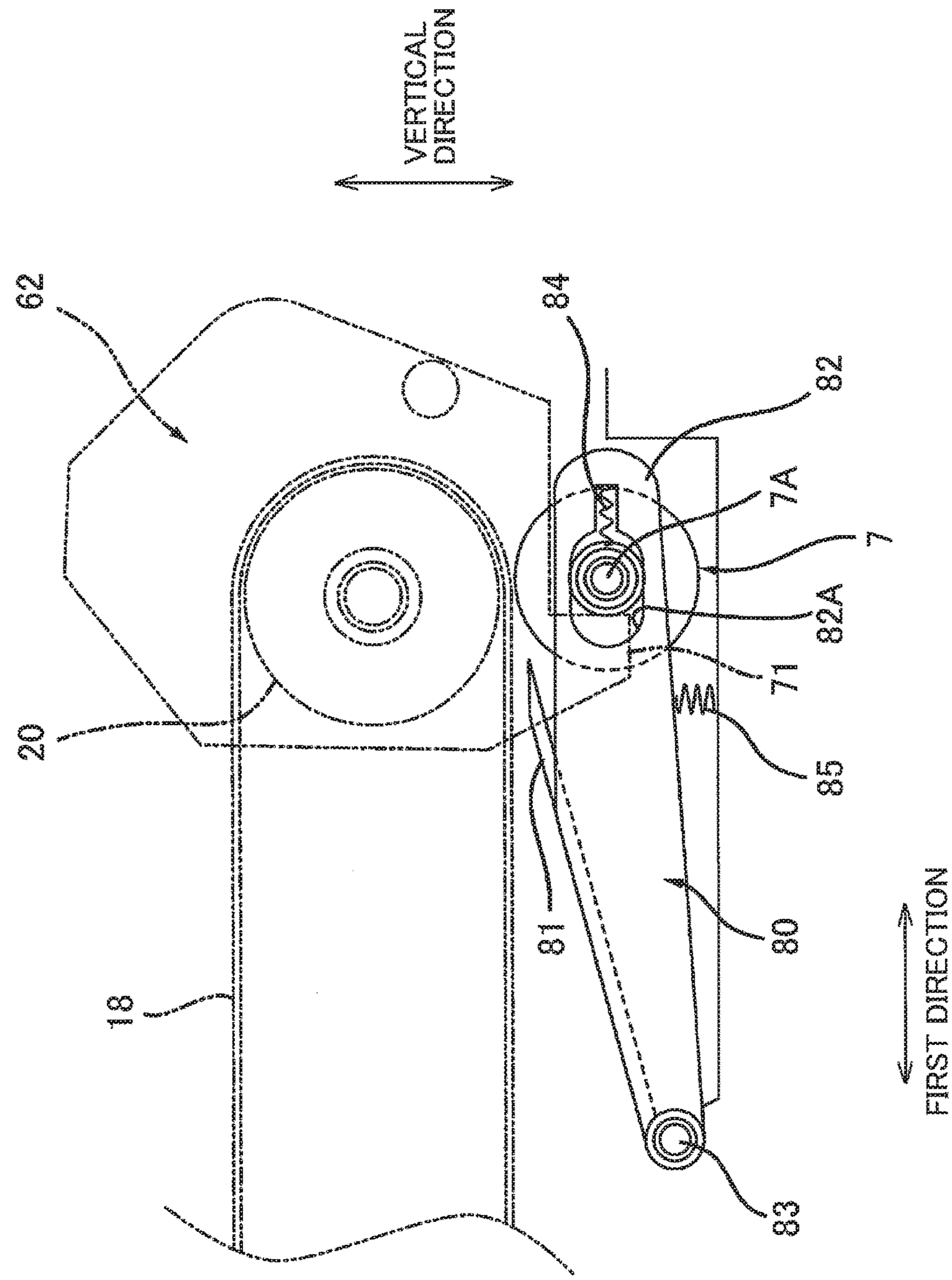

VERTICAL DIRECTION
62
84
82
7A
7
82A
71
85
20
81
80
18
83
FIRST DIRECTION

FIG. 8

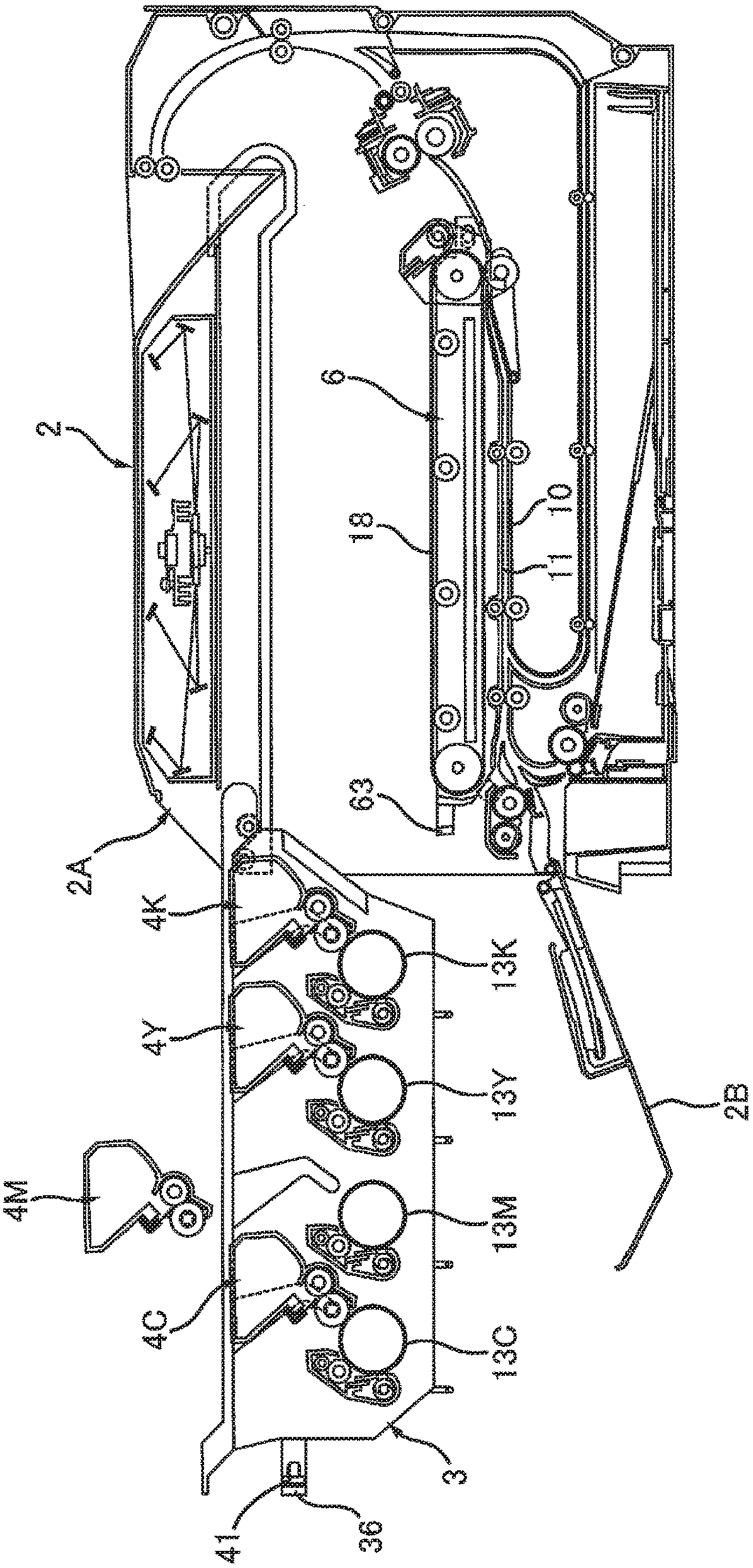

2
6
18
10
11
63
2A
4K
13K
4Y
13Y
4M
13M
4C
13C
3
41
36
2B
FIRST DIRECTION

FIG. 9

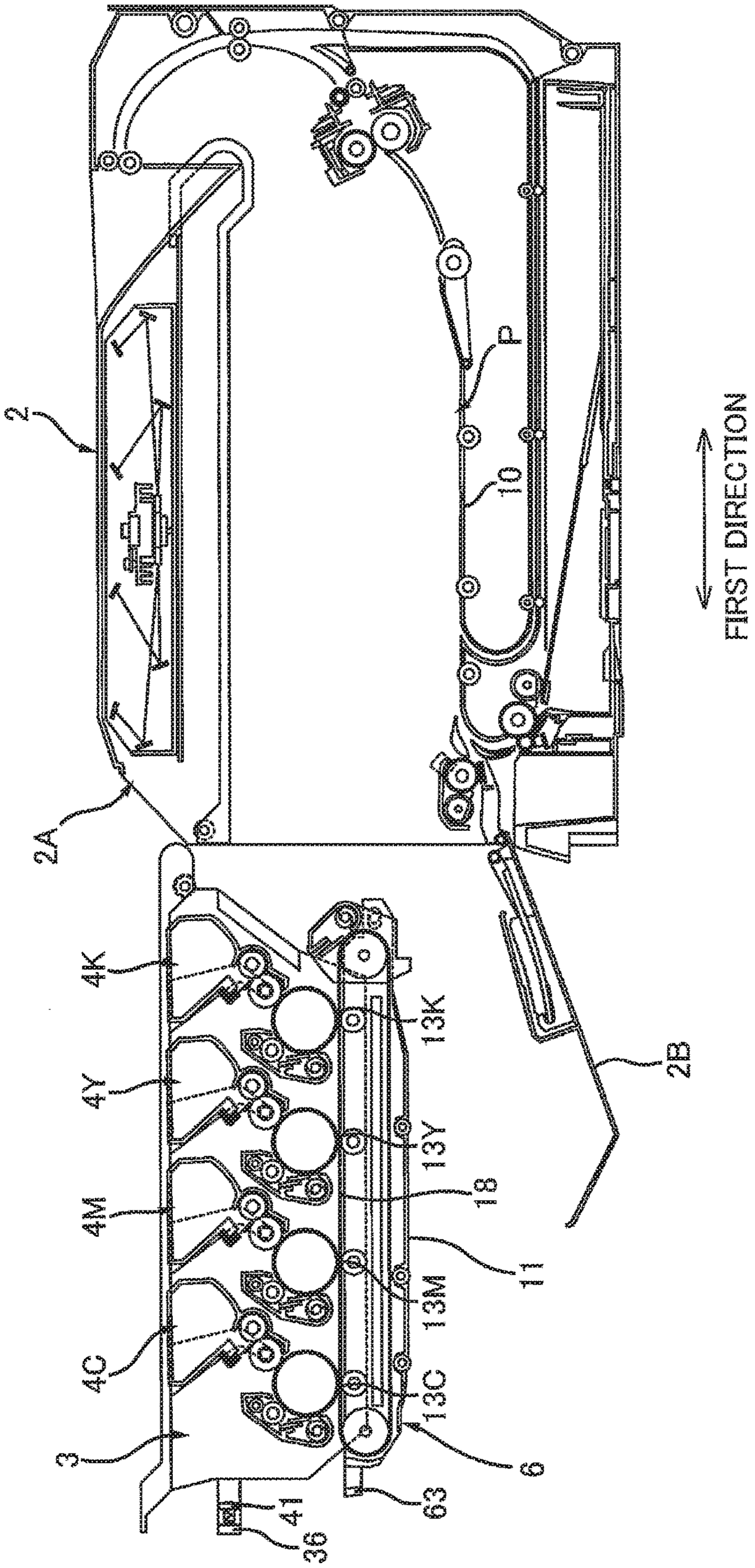

2
2A
2B
10
P
FIRST DIRECTION
4K
4Y
4M
4C
13K
13Y
13M
13C
18
11
3
41
36
63
6

FIG. 10

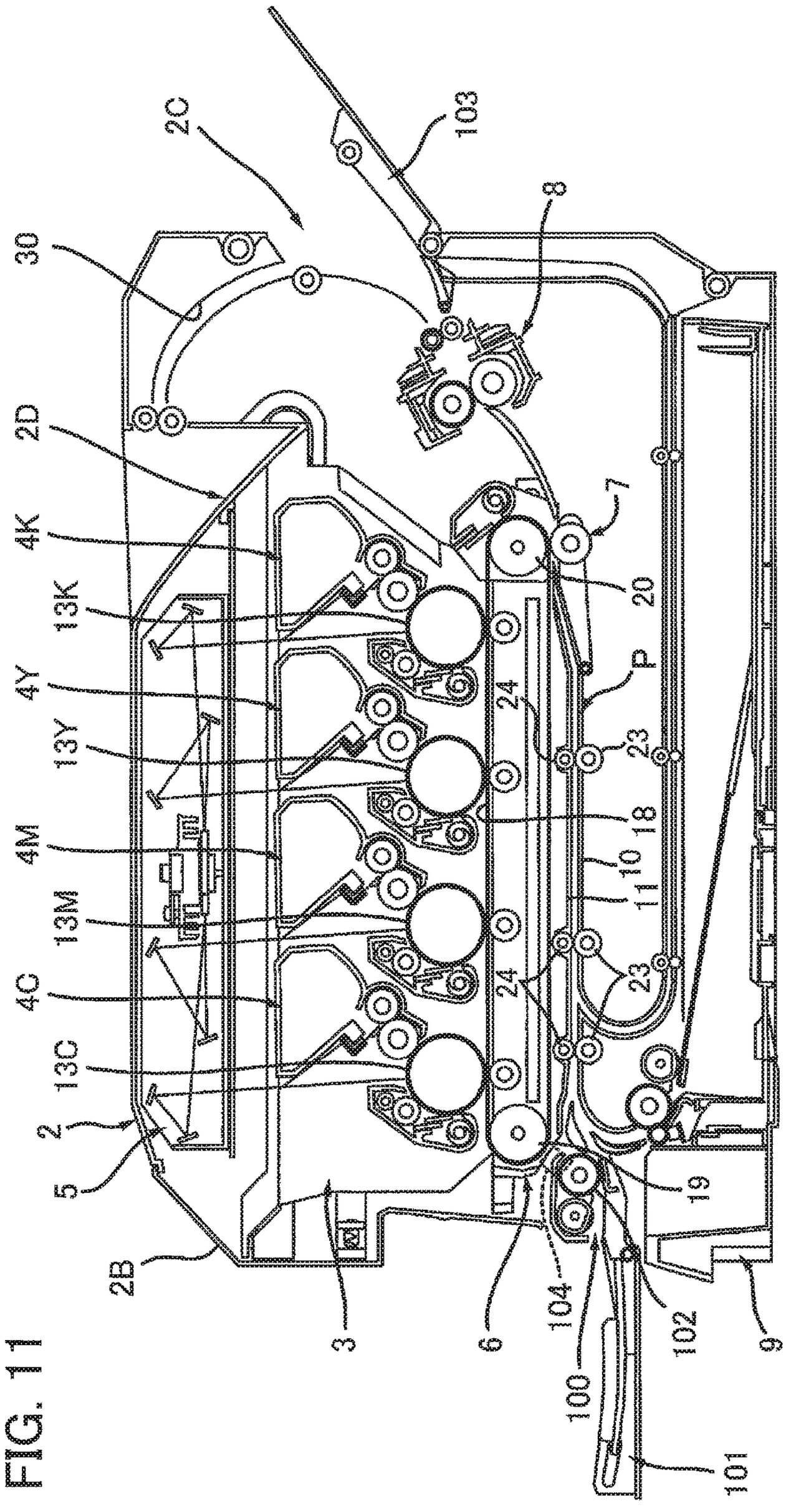

20
103
8
30
2D
4K
13K
4Y
13Y
4M
13M
4C
13C
2
5
2B
3
6
104
100
102
9
101
19
7
P
20
24
23
18
10
11
1
FIRST DIRECTION

FIG. 11

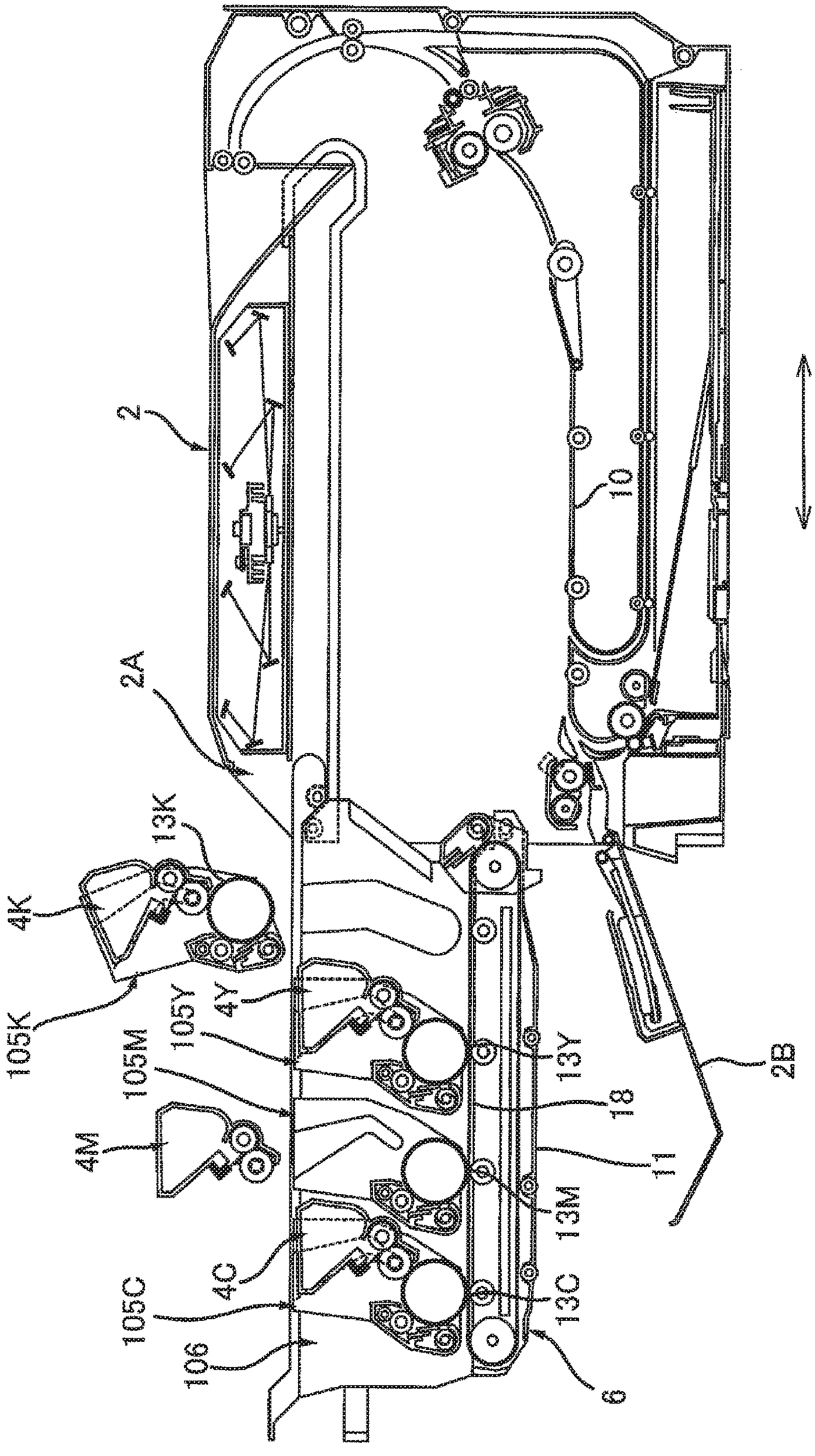

2
2A
2B
4K
4M
4C
4Y
105K
105M
105C
105Y
13K
13M
13C
13Y
10
11
18
6
106
FIRST DIRECTION

FIG. 12

IMAGE FORMING APPARATUS CAPABLE OF MOVING BELT UNIT TOGETHER WITH SUPPORT MEMBER

CROSS REFERENCE TO RELATED APPLICATION

This application claims priority from Japanese Patent Application No. 2017-037293 filed Feb. 28, 2017. The entire content of the priority application is incorporated herein by reference.

TECHNICAL FIELD

The present disclosure relates to an image forming apparatus.

BACKGROUND

There is conventionally known an intermediate transfer type image forming apparatus including: a support member supporting a photosensitive drum; a belt unit having a transfer belt; and a sheet conveying path extending below the belt unit. The support member is movable between an accommodated position at which the support member is accommodated in a main body casing and a withdrawn position at which the support member is withdrawn from the main body casing. When the support member is at the accommodated position, the support member is positioned above the belt unit so as to contact the transfer belt.

SUMMARY

However, in the image forming apparatus described above, in a case where a sheet of paper is jammed in the sheet conveying path, a user have to perform the following troublesome operations: removing the support member from the main body casing; and removing the belt unit from the main body casing; and then opening the sheet conveying path to remove the sheet jammed in the sheet conveying path.

In view of the foregoing, it is an object of the disclosure to provide an image forming apparatus in which a sheet conveying path can be opened smoothly for removal of a jammed paper sheet.

In order to attain the above and other objects, according to one aspect, the disclosure provides an image forming apparatus including: a main body casing; a photosensitive drum; a support member; a belt unit; a transfer roller; and a second sheet guide. The main body casing has an opening. The support member is configured to support the photosensitive drum. The support member is movable through the opening between a first accommodated position and a first withdrawn position. At the first accommodated position, the support member is accommodated in the main body casing. At the first withdrawn position, the support member is withdrawn from the main body casing. The belt unit is movable through the opening between a second accommodated position and a second withdrawn position. At the second accommodated position, the belt unit is accommodated in the main body casing. At the second withdrawn position, the belt unit is withdrawn from the main body casing. The belt unit includes: a first sheet guide; and a transfer belt. The transfer belt is configured to be in contact with the photosensitive drum in a state where the support member supporting the photosensitive drum is at the first accommodated position and where the belt unit is at the second accommodated position. The belt unit is positioned below the photosensitive drum in a state where the support member supporting the photosensitive drum is at the first accommodated position and where the belt unit is at the second accommodated position. The belt unit is movable from the second accommodated position to the second withdrawn position together with the support member in a case where the support member moves from the first accommodated position to the first withdrawn position. The transfer roller is configured to be in contact with an outer surface of the transfer belt in a state where the belt unit is at the second accommodated position. The second sheet guide is positioned below the belt unit and faces the first sheet guide to define a sheet conveying path between the first sheet guide and the second sheet guide in a state where the belt unit is at the second accommodated position. The second sheet guide is configured to convey a sheet along the sheet conveying path toward a position between the transfer belt and the transfer roller.

BRIEF DESCRIPTION OF THE DRAWINGS

The particular features and advantages of the embodiment(s) as well as other objects will become apparent from the following description taken in connection with the accompanying drawings, in which:

FIG. **1** is a schematic cross-sectional view of an image forming apparatus according to one embodiment;

FIG. **2**A is a side view of a drum unit and a belt unit of the image forming apparatus according to the embodiment, in which the drum unit and the belt unit are connected to each other;

FIG. **2**B is an explanatory diagram for explaining an operation of a shutter of the image forming apparatus according to the embodiment, in which the shutter is at a closed position;

FIG. **2**C is an explanatory diagram for explaining the operation of the shutter of the image forming apparatus according to the embodiment, in which the shutter is at an open position;

FIG. **3**A is a cross-sectional view of the drum unit and the belt unit of the image forming apparatus according to the embodiment taken along a line A-A in FIG. **2**A, in which a lever of the image forming apparatus is at an engagement position;

FIG. **3**B is a cross-sectional view of the drum unit and the belt unit of the image forming apparatus according to the embodiment taken along the line A-A in FIG. **2**A, in which the lever is at a disengagement position;

FIG. **4**A is a cross-sectional view of the drum unit of the image forming apparatus according to the embodiment taken along a line B-B in FIG. **2**A, in which a first grip of the drum unit is at a first position and a cam of the drum unit is at a pressure release position;

FIG. **4**B is a cross-sectional view of the drum unit of the image forming apparatus according to the embodiment taken along the line B-B in FIG. **2**A, in which the first grip of the drum unit is at a second position and the cam of the drum unit is at a pressure position;

FIG. **5** is a cross-sectional view of the belt unit illustrated in FIG. **2**A, in which cross-sections of a toner discharge portion and a belt toner conveying tube of the belt unit are illustrated so that a first elongated hole and a second elongated hole of the belt unit can be seen from an outside;

FIG. **6** is a cross-sectional view of the belt unit illustrated in FIG. **2**A, in which cross-sections of the toner discharge portion and the belt toner conveying tube of the belt unit are

illustrated so that a first toner receiving opening and a second toner receiving opening of the belt unit can be seen from an outside;

FIG. **7** is a cross-sectional view of the image forming apparatus according to the embodiment taken along a line C-C in FIG. **1**;

FIG. **8** is an explanatory diagram of a transfer roller support member of a main body casing of the image forming apparatus according to the embodiment;

FIG. **9** is an explanatory diagram of an operation of the image forming apparatus according to the embodiment, in which the drum unit is moved to a withdrawn position while the belt unit is at an accommodated position;

FIG. **10** is an explanatory diagram of the operation of the image forming apparatus according to the embodiment, in which the drum unit and the belt unit are at their respective withdrawn positions;

FIG. **11** is an explanatory diagram for further explaining the image forming apparatus according to the embodiment, in which a second sheet supply tray and a second discharge tray of the main body casing are at their respective open positions; and

FIG. **12** is an explanatory diagram of an image forming apparatus according to a modification of the embodiment.

DETAILED DESCRIPTION

An image forming apparatus **1** according to one embodiment will be described with reference to the accompanying drawings, wherein like parts and components are designated by the same reference numerals to avoid duplicating description.

1. Overall Structure of Image Forming Apparatus

With reference to FIG. **1**, an overall structure of the image forming apparatus **1** will be described.

The image forming apparatus **1** is an intermediate transfer type color printer. The image forming apparatus **1** includes a main body casing **2**, a drum unit **3** as an example of a support member, a plurality of developing cartridges **4**K, **4**Y, **4**M, and **4**C, a laser scanning unit **5**, a belt unit **6**, a transfer roller **7**, a fixing device **8**, a sheet supply tray **9**, a second sheet guide **10**, and a waste toner box **25** (see FIG. **7**).

1.1 Main Casing

The main body casing **2** constitutes an outer cover of the image forming apparatus **1**. The main body casing **2** has an opening **2**A. Further, the main body casing **2** has a front cover **2**B. The opening **2**A allows the drum unit **3** and the belt unit **6** to pass therethrough. The front cover **2**B is pivotally movable between an open position (see FIG. **9**) at which the opening **2**A is opened and a closed position (see FIG. **1**) at which the opening **2**A is closed.

1.2 Drum Unit

The drum unit **3** is movable, through the opening **2**A, between an accommodated position (see FIG. **1**) at which the drum unit **3** is accommodated in the main body casing **2** and a withdrawn position (see FIG. **9**) at which the drum unit **3** is withdrawn from the main body casing **2**. The accommodated position of the drum unit **3** at this time will also be referred to as a first accommodated position. Further, the withdrawn position of the drum unit **3** at this time will also be referred to as a first withdrawn position. The drum unit **3** is movable between the first accommodated position and the first withdrawn position in a first direction. At the first withdrawn position, the drum unit **3** is at least partly withdrawn to an outside of the main body casing **2**.

The drum unit **3** includes a plurality of photosensitive drums **13**K, **13**Y, **13**M, and **13**C, a plurality of charging rollers **14**K, **14**Y, **14**M, and **14**C, and a plurality of drum cleaners **15**K, **15**Y, **15**M, and **15**C.

The photosensitive drums **13**K, **13**Y, **13**M, and **13**C are arranged juxtaposed with one another and spaced apart from one another in the first direction. The photosensitive drum **13**K will also be referred to as a first photosensitive drum **13**K. Further, the photosensitive drum **13**Y will also be referred to as a second photosensitive drum **13**Y. The drum unit **3** further includes a first side frame **31** and a second side frame **32**. The first side frame **31** and the second side frame **32** will be described later in detail. The first side frame **31** and the second side frame **32** rotatably support the photosensitive drums **13**K, **13**Y, **13**M, and **13**C. That is, the drum unit **3** supports at least the first photosensitive drum **13**K, and the second photosensitive drum **13**Y arrayed with the first photosensitive drum **13**K in the first direction.

Note that the photosensitive drums **13**K, **13**Y, **13**M, and **13**C have the same structure as one another, the charging rollers **14**K, **14**Y, **14**M, and **14**C have the same structure as one another, and the drum cleaners **15**K, **15**Y, **15**M, and **15**C have the same structure as one another. Thus, the following description will be given with reference to the photosensitive drum **13**K, the charging roller **14**K, and the drum cleaner **15**K. Description of the photosensitive drums **13**Y, **13**M, and **13**C, the charging rollers **14**Y, **14**M, and **14**C, and the drum cleaners **15**Y, **15**M, and **15**C will be omitted.

The photosensitive drum **13**K is rotatable about a rotation axis that extends in an axial direction. The axial direction crosses the first direction. Preferably, the axial direction is orthogonal to the first direction. The photosensitive drum **13**K extends in the axial direction. The photosensitive drum **13**K has a cylindrical shape.

The charging roller **14**K is configured to charge a peripheral surface of the photosensitive drum **13**K. The charging roller **14**K is in contact with the peripheral surface of the photosensitive drum **13**K.

The drum cleaner **15**K has a cleaning blade **26** and an auger screw **27**.

The cleaning blade **26** is configured to remove toner from the photosensitive drum **13**K. The cleaning blade **26** is in contact with the peripheral surface of the photosensitive drum **13**K. The toner removed from the photosensitive drum **13**K by the cleaning blade **26** is accumulated inside the drum cleaner **15**K.

The auger screw **27** is configured to convey the toner removed from the photosensitive drum **13**K by the cleaning blade **26** toward a toner conveying tube **50** (see FIG. **3**A, described later). The auger screw **27** is positioned inside the drum cleaner **15**K. The auger screw **27** extends in the axial direction.

1.3 Developing Cartridge

The developing cartridges **4**K, **4**Y, **4**M, and **4**C have the same structure as one another. Thus, the following description will be given with reference to the developing cartridge **4**K, and description of the developing cartridges **4**Y, **4**M, and **4**C will be omitted.

The developing cartridge **4**K is detachably attached to the drum unit **3**. The developing cartridge **4**K is configured to supply toner to the peripheral surface of the photosensitive drum **13**K. Specifically, the developing cartridge **4**K can accommodate toner therein. The developing cartridge **4**K includes a developing roller **16**K. The developing roller **16**K is configured to supply the toner accommodated in the developing cartridge **4**K to the peripheral surface of the photosensitive drum **13**K. In a case where the developing

cartridge **4**K is attached to the drum unit **3**, the developing roller **16**K contacts the peripheral surface of the photosensitive drum **13**K.

1.4 Laser Scanning Unit

The laser scanning unit **5** is configured to expose the photosensitive drums **13**K, **13**Y, **13**M, and **13**C to light. Taking the photosensitive drum **13**K as an example, the laser scanning unit **5** exposes the peripheral surface of the photosensitive drum **13**K to light after the peripheral surface of the photosensitive drum **13**K is charged by the charging roller **14**K. As a result, an electrostatic latent image is formed on the peripheral surface of the photosensitive drum **13**K. Thereafter, toner is supplied to the electrostatic latent image by the developing cartridge **4**K, whereby a toner image is formed on the peripheral surface of the photosensitive drum **13**K.

1.5 Belt Unit

The belt unit **6** is configured to transfer the toner image on the peripheral surface of each of the photosensitive drums **13**K, **13**Y, **13**M, and **13**C onto a transfer belt **18** (described later). The belt unit **6** is movable between an accommodated position (see FIG. **1**) at which the belt unit **6** is accommodated in the main body casing **2** through the opening **2**A and a withdrawn position (see FIG. **10**) at which the belt unit **6** is withdrawn from the main body casing **2**. The accommodated position of the belt unit **6** at this time will also be referred to as a second accommodated position. Further, the withdrawn position of the belt unit **6** at this time will also be referred to as a second withdrawn position. At the second withdrawn position, the belt unit **6** is at least partly withdrawn to an outside of the main body casing **2**.

In a state where the drum unit **3** is at the first accommodated position and where the belt unit **6** is at the second accommodated position, the belt unit **6** is positioned below the photosensitive drums **13**K, **13**Y, **13**M, and **13**C.

The belt unit **6** includes a drive roller **19**, a driven roller **20**, the transfer belt **18**, a plurality of primary transfer rollers **21**K, **21**Y, **21**M, and **21**C, a belt cleaner **22**, and a first sheet guide **11**.

The drive roller **19** is configured to drive the transfer belt **18**. Specifically, the drive roller **19** is configured to circularly move the transfer belt **18**. The drive roller **19** is rotatable about a rotation axis that extends in the axial direction.

The driven roller **20** is configured to drive the transfer belt **18** in cooperation with the drive roller **19**. Specifically, the driven roller **20** is configured to circularly move the transfer belt **18** in cooperation with the drive roller **19**. The driven roller **20** is positioned spaced apart from the drive roller **19** in the first direction. The driven roller **20** is rotatable about a rotation axis that extends in the axial direction. The driven roller **20** rotates in conjunction with the transfer belt **18** as the drive roller **19** circularly moves the transfer belt **18**.

The transfer belt **18** is in contact with the photosensitive drums **13**K, **13**Y, **13**M, and **13**C in a state where the drum unit **3** is at the first accommodated position and where the belt unit **6** is at the second accommodated position. The transfer belt **18** is an endless belt. The transfer belt **18** is stretched around the drive roller **19** and the driven roller **20**. Specifically, the transfer belt **18** extends in the first direction in a state of being stretched around the drive roller **19** and the driven roller **20**. The transfer belt **18** circularly moves around the drive roller **19** and the driven roller **20**.

The primary transfer rollers **21**K, **21**Y, **21**M, and **21**C are positioned between the drive roller **19** and the driven roller **20** in the first direction. The primary transfer rollers **21**K, **21**Y, **21**M, and **21**C are arranged spaced apart from one another in the first direction. The primary transfer rollers **21**K, **21**Y, **21**M, and **21**C have the same structure as one another. Thus, the following description will be given with reference to the primary transfer roller **21**K, and description of the primary transfer rollers **21**Y, **21**M, and **21**C will be omitted. The primary transfer roller **21**K is configured to transfer the toner image formed on the surface of the photosensitive drum **13**K onto the transfer belt **18**. The transfer belt **18** is interposed between the primary transfer roller **21**K and the photosensitive drum **13**K in a state where the drum unit **3** is at the first accommodated position and where the belt unit **6** is at the second accommodated position.

The belt cleaner **22** includes a belt cleaning blade **28** and an auger screw **29**.

The belt cleaning blade **28** is configured to remove toner from the transfer belt **18**. The belt cleaning blade **28** is in contact with the transfer belt **18**. The toner removed from the transfer belt **18** by the belt cleaning blade **28** is accumulated inside the belt cleaner **22**.

The auger screw **29** is configured to convey the toner removed by the belt cleaning blade **28** toward the waste toner box **25**. Specifically, the auger screw **29** is configured to convey the toner removed from the transfer belt **18** by the belt cleaning blade **28** toward a belt toner conveying tube **64** (see FIG. **6**, described later). The auger screw **29** is positioned inside the belt cleaner **22**. The auger screw **29** extends in the axial direction.

The first sheet guide **11** is positioned between the transfer belt **18** and the second sheet guide **10** in a vertical direction. Although the first sheet guide **11** will be described later in detail, the first sheet guide **11** is positioned at a lower end portion of the belt unit **6**. The first sheet guide **11** is movable together with the transfer belt **18** during the movement of the belt unit **6** between the second accommodated position and the second withdrawn position. The first sheet guide **11** is positioned above the second sheet guide **10** and faces the second sheet guide **10** in a state where the belt unit **6** is at the second accommodated position. The first sheet guide **11** defines a sheet conveying path P in cooperation with the second sheet guide **10** in a state where the belt unit **6** is at the second accommodated position. The first sheet guide **11** includes a plurality of sheet conveying rollers **24**. The sheet conveying rollers **24** are an example of a first sheet conveying roller.

The sheet conveying rollers **24** are arranged spaced apart from one another in the first direction. The sheet conveying rollers **24** are configured to convey a sheet of paper along the sheet conveying path P toward a position between the transfer belt **18** and the transfer roller **7** in cooperation with a plurality of sheet conveying rollers **23** (described later). That is, the first sheet guide **11** is configured to convey a sheet along the sheet conveying path P toward the position between the transfer belt **18** and the transfer roller **7**.

1.6 Transfer Roller

The transfer roller **7** is a secondary transfer roller. The transfer roller **7** is configured to transfer the toner image transferred onto the transfer belt **18** onto a sheet. The transfer roller **7** is in contact with an outer surface of the transfer belt **18** in a state where the belt unit **6** is at the second accommodated position. Specifically, the transfer roller **7** nips the transfer belt **18** in cooperation with the driven roller **20**. The transfer roller **7** is positioned below the belt unit **6** in a state where the belt unit **6** is at the second accommodated position. Specifically, the transfer roller **7** is positioned below the driven roller **20** in a state where the belt unit **6** is at the second accommodated position.

1.7 Fixing Device

The fixing device **8** is configured to heat and pressurize a sheet onto which the toner image has been transferred to fix the toner image onto the sheet. The fixing device **8** is positioned opposite to the drive roller **19** with respect to the driven roller **20** in the first direction. The fixing device **8** is spaced apart from the transfer roller **7** in the first direction.

1.8 Sheet Supply Tray

The sheet supply tray **9** is configured to accommodate therein sheets of paper. Specifically, the sheet supply tray **9** includes a storage portion **9**A for accommodating sheets therein. The sheet supply tray **9** is movable relative to the main body casing **2** in the first direction. The sheet supply tray **9** is movable between an outside position at which the storage portion **9**A is positioned outside the main body casing **2** and an inside position at which the storage portion **9**A is positioned inside the main body casing **2**. Thus, a user can replenish the storage portion **9**A with sheets after moving the sheet supply tray **9** to the outside position. When the sheet supply tray **9** is at the inside position, the sheet supply tray **9** is positioned below the belt unit **6** at the second accommodated position.

1.9 Second Sheet Guide

The second sheet guide **10** is positioned below the belt unit **6** in a state where the belt unit **6** is at the second accommodated position. The second sheet guide **10** is positioned between the belt unit **6** and the sheet supply tray **9** in the vertical direction in a state where the belt unit **6** is at the second accommodated position. The second sheet guide **10** is positioned below the first sheet guide **11** and faces the first sheet guide **11** in a state where the belt unit **6** is at the second accommodated position. The second sheet guide **10** defines the sheet conveying path P in cooperation with the first sheet guide **11** in a state where the belt unit **6** is at the second accommodated position. The second sheet guide **10** includes the plurality of sheet conveying rollers **23**. The sheet conveying rollers **23** are an example of a second sheet conveying roller.

The sheet conveying rollers **23** are arranged spaced apart from one another in the first direction. The sheet conveying rollers **23** are configured to convey a sheet along the sheet conveying path P toward the position between the transfer belt **18** and the transfer roller **7** in cooperation with the plurality of sheet conveying rollers **24**. That is, the second sheet guide **10** is configured to convey a sheet along the sheet conveying path P toward the position between the transfer belt **18** and the transfer roller **7**.

The sheets accommodated in the sheet supply tray **9** are each fed to the position between the transfer belt **18** and the transfer roller **7** at a predetermined timing while being guided by the first sheet guide **11** and the second sheet guide **10**. As a result, a toner image is transferred onto the sheet. The sheet onto which the toner image has been transferred passes through the fixing device **8**. At this time, the toner image is fixed onto the sheet. Thereafter, the sheet that has passed through the fixing device **8** is guided upward by a discharge guide **30** positioned at the main body casing **2** in a state where a second discharge tray **103** (described later) is at a closed position and is then discharged onto a discharge tray 2D positioned at an upper surface of the main body casing **2**.

1.10 Waste Toner Box

As illustrated in FIG. **7**, the waste toner box **25** is positioned in the main body casing **2**. The toner removed by the drum cleaners **15**K, **15**Y, **15**M, and **15**C and the toner removed by the belt cleaner **22** are accommodated in the waste toner box **25**.

2. Detailed Description of Image Forming Apparatus

In the image forming apparatus **1**, the belt unit **6** is movable from the second accommodated position to the second withdrawn position together with the drum unit **3** in a case where the drum unit **3** moves from the first accommodated position to the first withdrawn position, as illustrated in FIG. **10**. Specifically, as illustrated in FIGS. **2**A and **3**A, the image forming apparatus **1** includes a plurality of levers **33**A and a plurality of levers **33**B as an example of a connector. The plurality of levers **33**A and the plurality of levers **33**B are configured to connect the drum unit **3** to the belt unit **6**. In a case where the drum unit **3** moves from the first accommodated position to the first withdrawn position, the belt unit **6** is movable from the second accommodated position to the second withdrawn position in a state where the belt unit **6** is connected to the drum unit **3** by the levers **33**A and the levers **33**B. This allows the belt unit **6** including the first sheet guide **11** to be withdrawn from the main body casing **2** together with the drum unit **3** in one single operation. Thus, the sheet conveying path P can be easily opened.

Next, the drum unit **3** and the belt unit **6** will be described in detail.

2.1 Detailed Description of Drum Unit

With reference to FIGS. **2**A through **4**B, the drum unit **3** will be described in detail.

The plurality of levers **33**A and the plurality of levers **33**B are respectively movable between an engagement position (see FIG. **3**A) and a disengagement position (see FIG. **3**B). At the engagement position, the levers **33**A and the levers **33**B are respectively in engagement with the belt unit **6**. At the disengagement position, the levers **33**A and the levers **33**B are respectively out of engagement with the belt unit **6**.

The drum unit **3** includes a cam **34**A, a cam **34**B, and a first handle **36**. The cam **34**A is configured to move the levers **33**A. The cam **34**B is configured to move the levers **33**B. The cam **34**A and the cam **34**B are an example of a link. The first handle **36** is connected to the cam **34**A and the cam **34**B. The drum unit **3** is configured such that a user's operation with the first handle **36** allows the levers **33**A and the levers **33**B to be moved between the engagement position and the disengagement position.

More specifically, as illustrated in FIGS. **2**A and **3**A, the drum unit **3** includes a first side frame **31**, a second side frame **32**, the plurality of levers **33**A, the plurality of levers **33**B, a plurality of springs **35**, the cam **34**A, the cam **34**B, the first handle **36**, the toner conveying tube **50**, and a shutter **49**.

The first side frame **31** extends in the first direction. The first side frame **31** has a flat plate-like shape. The first side frame **31** has a first surface **31**A and a second surface **31**B. The first surface **31**A faces the second side frame **32**. The second surface **31**B is positioned opposite to the first surface **31**A.

The second side frame **32** is positioned opposite to the first side frame **31** with respect to the photosensitive drums **13**K, **13**Y, **13**M, and **13**C in the axial direction. The second side frame **32** extends in the first direction. The second side frame **32** has a flat plate-like shape. The second side frame **32** has a first surface **32**A and a second surface **32**B. The first surface **32**A faces the first side frame **31**. The second surface **32**B is positioned opposite to the first surface **32**A.

2.1.1 Lever

The levers **33**A and the levers **33**B are configured to connect the drum unit **3** to the belt unit **6** in a state where the

drum unit **3** is positioned above the belt unit **6** and where the transfer belt **18** is in contact with the photosensitive drums **13**K, **13**Y, **13**M, and **13**C.

The levers **33**A are positioned at the second surface **31**B of the first side frame **31**. The levers **33**A are arranged spaced apart from one another in the first direction. That is, the drum unit **3** includes at least a first lever **33**A, and a second lever **33**A positioned away from the first lever **33**A in the first direction.

The levers **33**B are positioned at the second surface **32**B of the second side frame **32**. The levers **33**B are positioned opposite to the levers **33**A with respect to the belt unit **6** in the axial direction. That is, the drum unit **3** includes at least a third lever **33**B positioned opposite to the first lever **33**A and the second lever **33**A with respect to the belt unit **6** in the axial direction. The levers **33**B are arranged spaced apart from one another in the first direction. The levers **33**A and the levers **33**B have the same structure as each other. Thus, the following description will be given with reference to one of the plurality of levers **33**A, and description of the remaining levers **33**A and the levers **33**B will be omitted.

The lever **33**A is pivotally movable between the engagement position and the disengagement position. The lever **33**A extends in the vertical direction. The lever **33**A has an upper end E**1** and a lower end E**2**. The lower end E**2** is positioned lower than a lower end of the first side frame **31**. The lever **33**A includes a pivot shaft **37** and a protrusion **38**.

The pivot shaft **37** is positioned between the upper end E**1** and the lower end E**2** in the vertical direction. The pivot shaft **37** extends in the first direction. The pivot shaft **37** is rotatably attached to the first side frame **31**. The lever **33**A is pivotally movable about an axis of the pivot shaft **37**.

The protrusion **38** is fitted in a recess **72** (described later) of the belt unit **6** in a case where the lever **33**A is at the engagement position. As the protrusion **38** is fitted in the recess **72**, the lever **33**A engages with the belt unit **6**. The protrusion **38** protrudes from the lower end E**2** of the lever **33**A. The protrusion **38** extends in the axial direction.

The lever **33**A is urged by the spring **35** from the disengagement position toward the engagement position. The spring **35** is positioned between the upper end E**1** of the lever **33**A and the first side frame **31** in the axial direction. The spring **35** is a compression spring that extends in the axial direction. The spring **35** has one end and the other end in the axial direction. The one end of the spring **35** is in contact with the first side frame **31**. The other end of the spring **35** is in contact with the upper end E**1** of the lever **33**A. The spring **35** is compressed at a higher pressure in a case where the lever **33**A is at the disengagement position than at the engagement position. Thus, the spring **35** urges the lever **33**A from the disengagement position toward the engagement position.

2.1.2 Cam

As illustrated in FIGS. **3**A through **4**B, the cam **34**A is configured to move the levers **33**A from the engagement position to the disengagement position. Specifically, the cam **34**A is configured to press each of the levers **33**A such that the upper end E**1** of each lever **33**A moves closer to the first side frame **31** to thereby move the levers **33**A from the engagement position to the disengagement position. More specifically, the cam **34**A presses each of the levers **33**A at a portion thereof between the upper end E**1** and the pivot shaft **37**. As illustrated in FIG. **4**A, the cam **34**A is positioned opposite to the first side frame **31** with respect to the levers **33**A in the axial direction. The cam **34**A extends in the first direction. The cam **34**A is movable in the first direction between a pressure position (see FIG. **4**B) at which the cam **34**A presses the levers **33**A and a pressure release position (see FIG. **4**A) at which pressure applied to the levers **33**A by the cam **34**A is released. That is, the moving direction of the cam **34**A and the moving direction of the levers **33**A differ from each other. The cam **34**A has a plurality of cam surfaces **40**A.

The number of the cam surfaces **40**A corresponds to the number of the levers **33**A. The cam surfaces **40**A are arranged spaced apart from one another in the first direction. Each one of the plurality of cam surfaces **40**A is capable of contacting corresponding one of the plurality of levers **33**A. The cam surfaces **40**A have the same structure as one another. Thus, the following description will be given with reference to one of the cam surfaces **40**A, and description of the remaining cam surfaces **40**A will be omitted.

The cam surface **40**A is in contact with the corresponding lever **33**A during the movement of the cam **34**A from the pressure release position to the pressure position. The cam surface **40**A has an upstream edge and a downstream edge in a moving direction of the cam **34**A from the pressure release position to the pressure position. The cam surface **40**A is sloped such that the upstream edge of the cam surface **40**A is positioned closer to the first side frame **31** than the downstream edge of the cam surface **40**A to the first side frame **31**. With this structure, during the movement of the cam **34**A from the pressure release position to the pressure position, the cam **34**A presses the levers **33**A toward the first side frame **31** with the cam surfaces **40**A.

As illustrated in FIGS. **3**A through **4**B, the cam **34**B is configured to move the levers **33**B from the engagement position to the disengagement position. Specifically, the cam **34**B is configured to press each of the levers **33**B such that the upper end E**1** of each lever **33**B moves toward the second side frame **32** to thereby move the levers **33**B from the engagement position to the disengagement position. More specifically, the cam **34**B presses each of the levers **33**B at a portion thereof between the upper end E**1** and the pivot shaft **37**. As illustrated in FIG. **4**A, the cam **34**B is positioned opposite to the second side frame **32** with respect to the levers **33**B in the axial direction. The cam **34**B extends in the first direction. The cam **34**B is movable in the first direction between a pressure position (see FIG. **4**B) at which the cam **34**B presses the levers **33**B and a pressure release position (see FIG. **4**A) at which pressure applied to the levers **33**B by the cam **34**B is released. The cam **34**B has a plurality of cam surfaces **40**B.

The number of the cam surfaces **40**B corresponds to the number of the levers **33**B. The cam surfaces **40**B are arranged spaced apart from one another in the first direction. Each one of the plurality of cam surfaces **40**B is capable of contacting corresponding one of the plurality of levers **33**B. The cam surfaces **40**B have the same structure as one another. Thus, the following description will be given with reference to one of the cam surfaces **40**B, and description of the remaining cam surfaces **40**B will be omitted.

The cam surface **40**B is in contact with the corresponding lever **33**B during the movement of the cam **34**B from the pressure release position to the pressure position. The cam surface **40**B has an upstream edge and a downstream edge in the moving direction of the cam **34**B from the pressure release position to the pressure position. The cam surface **40**B is sloped such that the upstream edge of the cam surface **40**B is positioned closer to the second side frame **32** than the downstream edge of the cam surface **40**B to the second side frame **32**. With this structure, during the movement of the cam **34**B from the pressure release position to the pressure

position, the cam **34**B presses the levers **33**B toward the second side frame **32** with the cam surfaces **40**B.

2.1.3 First Handle

As illustrated in FIG. **9**, the first handle **36** is a handle for moving the drum unit **3** from the first accommodated position to the first withdrawn position. Specifically, the first handle **36** is a handle for moving the drum unit **3** from the first accommodated position to the first withdrawn position without moving the belt unit **6** from the second accommodated position to the second withdrawn position in a state where the drum unit **3** is at the first accommodated position and where the belt unit **6** is at the second accommodated position. As illustrated in FIG. **2**A, the drum unit **3** has one end **3**A and the other end **3**B. The one end **3**A of the drum unit **3** is positioned at an upstream side of the drum unit **3** in a withdrawal direction of the drum unit **3**, i.e., in a direction in which the drum unit **3** moves from the first accommodated position to the first withdrawn position. The other end **3**B of the drum unit **3** is positioned at a downtream side of the drum unit **3** in the withdrawal direction of the drum unit **3**. The first handle **36** is positioned at the other end **3**B. The first handle **36** is exposed to an outside through the opening **2**A in a case where the front cover **2**B is at the open position. The first handle **36** includes a first grip **41**, a second grip **42**, and a spring **43**.

The first grip **41** is configured to move the levers **33**A and the levers **33**B from the engagement position to the disengagement position. Specifically, as illustrated in FIG. **4**A, the first grip **41** is connected to both of the cam **34**A and the cam **34**B. More specifically, the first grip **41** extends in the axial direction. The first grip **41** has one end portion and the other end portion in the axial direction. The other end portion of the first grip **41** is positioned away from the one end portion of the first grip **41** in the axial direction. The one end portion of the first grip **41** is connected to the cam **34**A. The other end portion of the first grip **41** is connected to the cam **34**B. This allows the cam **34**A and the cam **34**B to be moved together with the first grip **41**.

The first grip **41** is movable relative to the second grip **42** between a first position (see FIG. **4**A) spaced apart from the second grip **42** and a second position (see FIG. **4**B) closer to the second grip **42** than the first position is to the second grip **42**. In a case where the first grip **41** is at the first position, the cam **34**A and the cam **34**B are at the pressure release position, and thus the levers **33**A and the levers **33**B are at the engagement position. In a case where the first grip **41** is at the second position, the cam **34**A and the cam **34**B are at the pressure position, and thus the levers **33**A and the levers **33**B are at the disengagement position.

That is, the cam **34**A and the cam **34**B move together with the first grip **41** in accordance with the movement of the first grip **41** from the first position to the second position. Further, the levers **33**A move from the engagement position to the disengagement position in accordance with the movement of the cam **34**A. Further, the levers **33**B move from the engagement position to the disengagement position in accordance with the movement of the cam **34**B. Thus, the levers **33**A and the levers **33**B move from the engagement position to the disengagement position in a case where the first grip **41** moves from the first position to the second position.

The second grip **42** faces the first grip **41** in the first direction. The second grip **42** is fixed to the other end **3**B of the drum unit **3**.

The spring **43** is positioned between the first grip **41** and the second grip **42**. The spring **43** presses the first grip **41** from the second position toward the first position.

2.1.4 Toner Conveying Tube

As illustrated in FIGS. **2**A and **3**A, the toner conveying tube **50** is configured to convey the toner removed by the cleaning blade **26** toward the waste toner box **25**. Specifically, the toner conveying tube **50** conveys the toner removed by the cleaning blade **26** toward the belt toner conveying tube **64**. The toner conveying tube **50** extends in the first direction. The toner conveying tube **50** includes a screw **50**B for conveying the toner. The screw **50**B is positioned inside the toner conveying tube **50**. The toner conveying tube **50** is connected to the drum cleaners **15**K, **15**Y, **15**M, and **15**C. The toner conveying tube **50** has one end portion E**11** and the other end portion E**12**. The one end portion E**11** of the toner conveying tube **50** is positioned at an upstream side of the toner conveying tube **50** in the withdrawal direction of the drum unit **3**. The other end portion E**12** of the toner conveying tube **50** is positioned at a downstream side of the toner conveying tube **50** in the withdrawal direction of the drum unit **3**. The toner conveying tube **50** has a first toner discharge opening **50**A. The first toner discharge opening **50**A is positioned at the one end portion E**11** of the toner conveying tube **50**. The toner conveyed through the toner conveying tube **50** is discharged from the first toner discharge opening **50**A.

Further, as illustrated in FIG. **3**A, the toner conveying tube **50** is positioned at the first surface **31**A of the first side frame **31**. The toner conveying tube **50** is positioned between the levers **33**A and a first wall **65** (described later) of the belt unit **6** in the axial direction in a state where the drum unit **3** is positioned above the belt unit **6** and where the transfer belt **18** is in contact with the photosensitive drums **13**K, **13**Y, **13**M, and **13**C. This configuration can prevent the toner conveying tube **50** from interfering with the movement of the levers **33**A.

2.1.5 Shutter

As illustrated in FIGS. **2**B and **2**C, the shutter **49** is movable between an open position (see FIG. **2**C) at which the first toner discharge opening **50**A is opened and a closed position (see FIG. **2**B) at which the first toner discharge opening **50**A is closed. Specifically, the shutter **49** is pivotally movable between the open position and the closed position. The shutter **49** is located at the open position by contacting a portion of the belt unit **6** in a state where the drum unit **3** is positioned above the belt unit **6** and where the transfer belt **18** is in contact with the photosensitive drums **13**K, **13**Y, **13**M, and **13**C. The shutter **49** is located at the closed position in a state where the drum unit **3** is separated from the belt unit **6** and where the shutter **49** is out of contact with the portion of the belt unit **6**. Specifically, a contact surface **60** (described later) serves as the portion of the belt unit **6**. The shutter **49** has a protrusion **49**A that is configured to contact the contact surface **60**. The protrusion **49**A extends from the shutter **49**.

2.2 Detailed Description of Belt Unit

As illustrated in FIG. **5**, the belt unit **6** includes a main frame **61**, a sub-frame **62**, a second handle **63**, the belt toner conveying tube **64** (see FIG. **6**), and the contact surface **60**.

2.2.1 Main Frame

As illustrated in FIGS. **3**A and **5**, the main frame **61** supports the drive roller **19** and the primary transfer rollers **21**K, **21**Y, **21**M, and **21**C. Further, the main frame **61** includes the first wall **65**, a second wall **66**, an engagement portion **67**A, an engagement portion **67**B, and the first sheet guide **11**.

As illustrated in FIG. **3**A, the first wall **65** is positioned between the first side frame **31** and the second side frame **32** in the axial direction. As illustrated in FIG. **5**, the first wall

65 extends in the first direction. The first wall 65 has a flat plate-like shape. The first wall 65 has a first elongated hole 65A and a second elongated hole 65B. The first elongated hole 65A and the second elongated hole 65B are elongated in the first direction. A first boss 69 (described later) of the sub-frame 62 is fitted in the first elongated hole 65A. A second boss 70 (described later) of the sub-frame 62 is fitted in the second elongated hole 65B. With this arrangement, the main frame 61 movably supports the sub-frame 62 in the first direction.

As illustrated in FIG. 3A, the second wall 66 is positioned between the first wall 65 and the second side frame 32 in the axial direction. The second wall 66 is spaced apart from the first wall 65 in the axial direction. The second wall 66 is positioned opposite to the first wall 65 with respect to the primary transfer rollers 21K, 21Y, 21M, and 21C in the axial direction. The second wall 66 is positioned opposite to the first wall 65 with respect to the drive roller 19 in the axial direction. The second wall 66 extends in the first direction. The second wall 66 has a flat plate-like shape. The second wall 66 has at least a third elongated hole (not illustrated) having the same shape as the shape of the first elongated hole 65A. The second wall 66 may have a fourth elongated hole (not illustrated) having the same shape as the shape of the second elongated hole 65B.

As illustrated in FIG. 3A, the engagement portion 67A engages with the levers 33A in a case where the levers 33A are each at the engagement position in a state where the drum unit 3 is positioned above the belt unit 6 and where the transfer belt 18 is in contact with the photosensitive drums 13K, 13Y, 13M, and 13C. The engagement portion 67A is positioned opposite to the second wall 66 with respect to the first wall 65 in the axial direction. The engagement portion 67A protrudes in the axial direction from the first wall 65. As illustrated in FIG. 5, the engagement portion 67A extends in the first direction. The engagement portion 67A has a plurality of recesses 72.

The number of the recesses 72 corresponds to the number of the levers 33A. The recesses 72 are arranged spaced apart from one another in the first direction. As illustrated in FIG. 3A, the protrusion 38 of one of the plurality of levers 33A is fitted in corresponding one of the plurality of recesses 72. The recesses 72 are each positioned at a protruding end of the engagement portion 67A in the axial direction. The recesses 72 are each recessed in the axial direction from the protruding end of the engagement portion 67A toward the first wall 65.

As illustrated in FIG. 3A, the engagement portion 67B engages with the levers 33B in a case where the levers 33B are each at the engagement position in a state where the drum unit 3 is positioned above the belt unit 6 and where the transfer belt 18 is in contact with the photosensitive drums 13K, 13Y, 13M, and 13C. The engagement portion 67B is positioned opposite to the first wall 65 with respect to the second wall 66 in the axial direction. The engagement portion 67B protrudes in the axial direction from the second wall 66. The engagement portion 67B extends in the first direction. The engagement portion 67B has a plurality of recesses 73.

The number of the recesses 73 corresponds to the number of the levers 33B. The recesses 73 are arranged spaced apart from one another in the first direction. The protrusion 38 of one of the plurality of levers 33B is fitted in corresponding one of the plurality of recesses 73. The recesses 73 are each positioned at a protruding end of the engagement portion 67B in the axial direction. The recesses 73 are each recessed in the axial direction from the protruding end of the engagement portion 67B toward the second wall 66.

As illustrated in FIG. 3A, the first sheet guide 11 is positioned at a lower end portion of the main frame 61. The first sheet guide 11 is positioned between the first wall 65 and the second wall 66 in the axial direction. The first sheet guide 11 extends in the axial direction and the first direction. The first sheet guide 11 has a flat plate-like shape. The first sheet guide 11 has one end portion and the other end portion in the axial direction. The other end portion of the first sheet guide 11 is positioned away from the one end portion of the first sheet guide 11 in the axial direction. The one end portion of the first sheet guide 11 is connected to the first wall 65. The other end portion of the first sheet guide 11 is connected to the second wall 66. Thus, during the movement of the belt unit 6 between the second accommodated position and the second withdrawn position, the first sheet guide 11 is movable together with the transfer belt 18.

2.2.2 Sub-Frame

As illustrated in FIG. 5, the sub-frame 62 is movable relative to the main frame 61. The belt cleaner 22 (see FIG. 1) is positioned inside the sub-frame 62. That is, the sub-frame 62 supports the belt cleaning blade 28 and the auger screw 29. The sub-frame 62 is positioned between the first wall 65 and the second wall 66 in the axial direction. The sub-frame 62 extends in the axial direction. The sub-frame 62 has one end portion 62A and the other end portion (not illustrated) in the axial direction. The other end portion of the sub-frame 62 is positioned opposite to the one end portion 62A of the sub-frame 62 in the axial direction. The sub-frame 62 includes the first boss 69, the second boss 70, a toner discharge portion 68, and a protrusion 71.

The first boss 69 protrudes from the one end portion 62A of the sub-frame 62. The first boss 69 extends in the axial direction. The first boss 69 has a hollow cylindrical shape. One end portion of a shaft 20A of the driven roller 20 is fitted in the first boss 69. Incidentally, the other end portion (not illustrated) of the sub-frame 62 includes a third boss (not illustrated) having the same structure as the first boss 69. The other end portion of the shaft 20A of the driven roller 20 is fitted in the third boss. The sub-frame 62 supports the driven roller 20 by the shaft 20A fitted in the first boss 69 and the third boss. Further, the first boss 69 is fitted in the first elongated hole 65A of the first wall 65. The third boss is fitted in the third elongated hole of the second wall 66. As the first boss 69 and the third boss are fitted in the first elongated hole 65A and the third elongated hole, respectively, the sub-frame 62 is movable in the first direction relative to the main frame 61. The first boss 69 is pressed by a spring 74 in a direction parallel to the first direction and away from the drive roller 19. The third boss is pressed by a spring (not illustrated) in the direction parallel to the first direction and away from the drive roller 19. Thus, the driven roller 20 is pressed in the direction parallel to the first direction and away from the drive roller 19. As a result, a predetermined tension is applied to the transfer belt 18.

The second boss 70 protrudes from the one end portion 62A of the sub-frame 62. The second boss 70 is spaced apart from the first boss 69. The second boss 70 extends in the axial direction. The second boss 70 has a columnar shape. The second boss 70 is fitted in the second elongated hole 65B of the first wall 65. This prevents the sub-frame 62 from rotating about the first boss 69. Hence, the belt cleaning blade 28 (see FIG. 1) can be brought into contact with the transfer belt 18 reliably. In a case where the second wall 66 has the fourth elongated hole, the other end portion of the sub-frame 62 includes the fourth boss having the same

structure as the second boss **70**. In this case, the fourth boss may be fitted in the fourth elongated hole.

The toner discharge portion **68** is configured to discharge toner removed by the belt cleaning blade **28**. The toner discharge portion **68** protrudes from the one end portion **62**A of the sub-frame **62**. The toner discharge portion **68** extends in the axial direction. The toner discharge portion **68** has a hollow cylindrical shape. The auger screw **29** is positioned inside the toner discharge portion **68**. As illustrated in FIG. **6**, the toner discharge portion **68** has an opening **68**A. The opening **68**A allows toner conveyed by the auger screw **29** to be discharged therethrough.

As illustrated in FIG. **8**, the protrusion **71** is in contact with a shaft **7**A of the transfer roller **7** in a case where the belt unit **6** is at the second accommodated position. The protrusion **71** protrudes downward from the sub-frame **62**. The protrusion **71** extends in the vertical direction.

2.2.3 Second Handle

As illustrated in FIGS. **9** and **10**, the second handle **63** is a handle for moving the belt unit **6** from the second accommodated position to the second withdrawn position. As illustrated in FIG. **5**, the belt unit **6** has one end **6**A and the other end **6**B. The one end **6**A of the belt unit **6** is positioned at an upstream side of the belt unit **6** in the withdrawal direction of the drum unit **3**. The other end **6**B of the belt unit **6** is positioned at a downstream side of the belt unit **6** in the withdrawal direction of the drum unit **3**. The second handle **63** is positioned at the other end **6**B. The second handle **63** is exposed to an outside through the opening **2**A in a case where the front cover **2**B is at the open position. The belt unit **6** is movable by the second handle **63** together with the drum unit **3** in a state where the drum unit **3** is positioned above the belt unit **6** and where the transfer belt **18** is in contact with the photosensitive drums **13**K, **13**Y, **13**M, and **13**C.

2.2.4 Belt Toner Conveying Tube

As illustrated in FIG. **6**, the belt toner conveying tube **64** is attached to the first wall **65** of the main frame **61**. Thus, the main frame **61** supports the belt toner conveying tube **64**. The belt toner conveying tube **64** extends in the first direction. The belt toner conveying tube **64** is configured to receive toner removed by the belt cleaning blade **28** (see FIG. **1**). The belt toner conveying tube **64** is also configured to receive toner conveyed through the toner conveying tube **50** (see FIG. **2**A). The belt toner conveying tube **64** has a first toner receiving opening **64**A, a second toner receiving opening **64**B, and a second toner discharge opening **64**C. The first toner receiving opening **64**A and the second toner receiving opening **64**B are an example of a toner receiving opening.

The first toner receiving opening **64**A is in communication with the first toner discharge opening **50**A of the toner conveying tube **50** in a state where the drum unit **3** is at the first accommodated position and where the belt unit **6** is at the second accommodated position. In this state, the first toner receiving opening **64**A can receive toner conveyed through the toner conveying tube **50**.

The second toner receiving opening **64**B is in communication with the opening **68**A of the sub-frame **62**. Thus, the second toner receiving opening **64**B can receive toner removed by the belt cleaning blade **28**. The second toner receiving opening **64**B is spaced apart from the first toner receiving opening **64**A in the first direction.

The second toner discharge opening **64**C is an opening for discharging toner in the belt toner conveying tube **64**. The second toner discharge opening **64**C is in communication with the waste toner box **25** in a state where the belt unit **6** is at the second accommodated position. Specifically, as illustrated in FIGS. **6** and **7**, the second toner discharge opening **64**C is in communication with the waste toner box **25** through a main body toner conveying tube **110** in a state where the belt unit **6** is at the second accommodated position. With this configuration, toner discharged from the second toner discharge opening **64**C is accommodated in the waste toner box **25** through the main body toner conveying tube **110**.

2.2.5 Contact Surface

As illustrated in FIG. **2**C, the contact surface **60** is in contact with the protrusion **49**A of the shutter **49** in a state where the drum unit **3** and the belt unit **6** are connected to each other to locate the shutter **49** at the open position. The contact surface **60** contacts the shutter **49** in a case where the drum unit **3** moves from the first withdrawn position to the first accommodated position in a state where the belt unit **6** is at the second accommodated position. As a result, the contact surface **60** moves the shutter **49** from the closed position to the open position. The contact surface **60** maintains the contact with the shutter **49** so that the shutter **49** is held at the open position in a case where the belt unit **6** moves from the second accommodated position to the second withdrawn position together with the drum unit **3**. As illustrated in FIG. **5**, the contact surface **60** constitutes a portion of the main frame **61**. Specifically, the contact surface **60** constitutes a portion of the first wall **65** of the main frame **61**. The contact surface **60** is positioned at an upper end portion of the first wall **65**.

2.3 Transfer Roller Support Member

As illustrated in FIG. **8**, the main body casing **2** includes a transfer roller support member **80**. The transfer roller support member **80** supports the transfer roller **7**. The transfer roller support member **80** is pivotally movable about a pivot axis **83** that extends in the axial direction. The transfer roller support member **80** includes a third sheet guide **81**, an arm **82**, a first spring **84**, and a second spring **85**. The third sheet guide **81** constitutes a portion of the second sheet guide **10**. The arm **82** supports the transfer roller **7**.

The third sheet guide **81** is configured to guide a sheet conveyed by the sheet conveying rollers **23** (see FIG. **1**) and the sheet conveying rollers **24** (see FIG. **1**) to a position between the transfer belt **18** and the transfer roller **7**.

The arm **82** extends from the third sheet guide **81** toward the transfer roller **7**. The arm **82** has an elongated hole **82**A that is elongated in the first direction. The elongated hole **82**A receives the shaft **7**A of the transfer roller **7**. With this configuration, the transfer roller **7** is rotatably supported by the arm **82** and movable in the first direction.

The first spring **84** presses the shaft **7**A of the transfer roller **7** in the withdrawal direction of the drum unit **3**. The first spring **84** is positioned in the elongated hole **82**A. The first spring **84** is in contact with the shaft **7**A.

The second spring **85** presses the arm **82** upward. Thus, in a case where the belt unit **6** is at the second accommodated position, the transfer roller **7** is pressed toward the transfer belt **18**. That is, the transfer roller **7** is urged toward the transfer belt **18** in the vertical direction. The second spring **85** is positioned below the arm **82**. The second spring **85** is in contact with the arm **82**.

In a case where the belt unit **6** is at the second accommodated position, the protrusion **71** of the sub-frame **62** is positioned opposite to the first spring **84** with respect to the shaft **7**A in the first direction. The protrusion **71** is in contact with the shaft **7**A. Thus, in a case where the sub-frame **62** moves in the direction parallel to the first direction and away

from the drive roller **19**, the protrusion **71** presses the shaft **7**A, whereby the transfer roller **7** moves, together with the sub-frame **62**, in the direction parallel to the first direction and away from the drive roller **19** against the pressing force of the first spring **84**. On the other hand, in a case where the sub-frame **62** moves in a direction parallel to the first direction and toward the drive roller **19**, the first spring **84** presses the shaft **7**A, whereby the transfer roller **7** moves, together with the sub-frame **62**, in the direction parallel to the first direction and toward the drive roller **19**. As described above, the transfer roller **7** is movable in the first direction together with the sub-frame **62**. As a result, the position of the transfer roller **7** relative to the driven roller **20** can be maintained in a configuration where the driven roller **20** is movable relative to the drive roller **19**.

3. Operation of Moving Drum Unit **3**

Next, an operation of moving the drum unit **3** from the first accommodated position to the first withdrawn position in a state where the belt unit **6** is at the second accommodated position will be described.

In order to move the drum unit **3** from the first accommodated position to the first withdrawn position in a state where the belt unit **6** is at the second accommodated position as illustrated in FIG. **9**, a user holds the first handle **36** without holding the second handle **63** to move the first grip **41** from the first position to the second position as illustrated in FIG. **4**B.

Then, in accordance with the movement of the first grip **41** from the first position to the second position, the cam **34**A and the cam **34**B moves from the pressure release position to the pressure position.

Then, the levers **33**A are pressed by the cam surfaces **40**A of the cam **34**A to be moved from the engagement position to the disengagement position. Similarly, the levers **33**B are pressed by the cam surfaces **40**B of the cam **34**B to be moved from the engagement position to the disengagement position.

As a result, as illustrated in FIG. **3**B, engagement between the levers **33**A and the belt unit **6** and engagement between the levers **33**B and the belt unit **6** are released.

Thereafter, as the user pulls the first handle **36** in a state where the first grip **41** is at the second position, the drum unit **3** moves from the first accommodated position to the first withdrawn position in a state where the belt unit **6** is at the second accommodated position, as illustrated in FIG. **9**.

4. Operation of Withdrawing Belt Unit **6**

Next, an operation of withdrawing the belt unit **6** and the drum unit **3** together from the main body casing **2** will be described.

In order to withdraw the drum unit **3** at the first accommodated position and the belt unit **6** at the second accommodated position from the main body casing **2** in a state where the drum unit **3** and the belt unit **6** are connected to each other as illustrated in FIG. **10**, the user pulls the second handle **63** without holding the first handle **36**.

At this time, the first grip **41** is at the first position, so that the levers **33** and the levers **33**B connect the drum unit **3** to the belt unit **6**, as illustrated in FIG. **3**A. That is, the levers **33**A and the levers **33**B connect the drum unit **3** to the belt unit **6** during the movement of the drum unit **3** from the first accommodated position to the first withdrawn position.

Thus, the belt unit **6** moves, together with the drum unit **3**, from the second accommodated position to the second withdrawn position as illustrated in FIG. **10** in a state where the levers **33**A and the levers **33**B are at the engagement position.

Further, at this time, the first sheet guide **11** is withdrawn to an outside of the main body casing **2** together with the transfer belt **18**. Accordingly, the first sheet guide **11** is separated away from the second sheet guide **10** such that the sheet conveying path P is exposed to the opening **2**A of the main body casing **2** in a case where the drum unit **3** moves from the first accommodated position to the first withdrawn position and where the belt unit **6** moves from the second accommodated position to the second withdrawn position.

5. Operational Advantages

According to the image forming apparatus **1**, the belt unit **6** including the first sheet guide **11** can be withdrawn from the main body casing **2** together with the drum unit **3** as illustrated in FIG. **10** by a single operation of moving the drum unit **3** from the first accommodated position to the first withdrawn position.

Thus, in a case where a sheet is jammed in the sheet conveying path P, the sheet conveying path P can be smoothly opened by the operation of moving the drum unit **3** from the first accommodated position to the first withdrawn position, thereby allowing the jammed sheet to be removed.

6. Further Details of Image Forming Apparatus

As illustrated in FIG. **11**, the image forming apparatus **1** further includes a second sheet supply tray **101**, a second supply roller **102**, a second discharge tray **103**, and a sensor **104**.

The second sheet supply tray **101** is attached to the front cover **2**B. The second sheet supply tray **101** is movable between a closed position (see FIG. **1**) at which an opening **100** of the front cover **2**B is closed and an open position (see FIG. **11**) at which the opening **100** is opened. Sheets of paper can be placed on the second sheet supply tray **101** in a state where the second sheet supply tray **101** is at the open position. The second sheet supply tray **101** at the open position is positioned opposite to the fixing device **8** with respect to the first sheet guide **11** in the first direction. The second sheet supply tray **101** at the open position extends in the first direction.

The second supply roller **102** is configured to convey the sheets placed on the second sheet supply tray **101** to a position between the first sheet guide **11** and the second sheet guide **10**. The second supply roller **102** is positioned between the second sheet supply tray **101** and the first sheet guide **11** in the first direction.

The second discharge tray **103** is a tray on which a sheet that has passed through the fixing device **8** is placed. The second discharge tray **103** is configured to suppress the sheet that has passed through the fixing device **8** from curling. The sheet that has passed through the fixing device **8** is discharged on the second discharge tray **103**. The second discharge tray **103** is positioned opposite to the transfer roller **7** with respect to the fixing device **8** in the first direction. The second discharge tray **103** is movable between an open position at which a second opening **2**C of the main body casing **2** is opened and a closed position at which the second opening **2**C is closed. The second discharge tray **103** at the open position extends in the first

direction. Specifically, the second discharge tray **103** at the open position extends in a direction of a sheet passing through the fixing device **8**.

The sensor **104** is configured to inspect the surface of the transfer belt **18**. The sensor **104** is positioned below the drive roller **19**. The sensor **104** faces the surface of the transfer belt **18**. The sensor **104** and the second supply roller **102** are arrayed in the axial direction.

The sensor **104** is used mainly for color shift correction, color correction, and the like. However, the sensor **104** may be used also for adjustment of sheet conveying timing.

By measuring a leading end of a toner image or a marking formed on the surface of the transfer belt **18**, the timing of the sheet conveying rollers **23** and the sheet conveying rollers **24** can be adjusted, whereby accurate positioning of an image to be formed on a sheet can be performed.

More specifically, the sheet conveying roller **23** and the sheet conveying roller **24** positioned closest to the transfer roller **7** are made to function as a registration roller pair. Hence, a sheet can be fed to a position between the transfer roller **7** and the transfer belt **18** in timed relation with a signal from the sensor **104**.

At this time, a lower portion of the outer surface of the transfer belt **18**, that is, a portion of the outer surface of the transfer belt **18** that is not in contact with the photosensitive drums **13**K, **13**Y, **13**M, and **13**C is moved in the first direction toward a position between the transfer belt **18** and the transfer roller **7** in the same manner as the sheet conveyed on the sheet conveying path P constituted by the first sheet guide **11** and the second sheet guide **10** is.

Further, the transfer roller **7** is in contact with the lower portion of the outer surface of the transfer belt **18** from below. Hence, the sheet and the transfer belt **18** are moved to the position between the transfer belt **18** and the transfer roller **7** substantially in the first direction without curving.

Thus, even if the driven roller **20** and the transfer roller **7** move in the first direction, a variation in the distance from the sheet conveying rollers **23** and **24** positioned closest to the transfer roller **7** to the position between the transfer belt **18** and the transfer roller **7** is substantially equal to a variation in the distance from the position on the transfer belt **18** that the sensor **104** faces to the position between the transfer belt **18** and the transfer roller **7**. Therefore, occurrence of positional displacement of images to be formed on a sheet can be suppressed.

7. Modifications

While the description has been made in detail with reference to the embodiments thereof, it would be apparent to those skilled in the art that many modifications and variations may be made therein without departing from the scope of the disclosure.

The image forming apparatus **1** according to the embodiment includes the drum unit **3**. However, according to a modification of the embodiment, the image forming apparatus **1** may include a frame **106** as an example of a support member, in place of the drum unit **3**.

As illustrated in FIG. **12**, the photosensitive drums **13**K, **13**Y, **13**M, and **13**C are detachably supported at the frame **106**. That is, the frame **16** may detachably support a plurality of process cartridges **105**K, **105**Y, **105**M, and **105**C. The process cartridges **105**K, **105**Y, **105**M, and **105**C have the same structure as one another. Thus, the following descriptions will be given with reference to the process cartridge **105**K, and description of the process cartridges **105**Y, **105**M, and **105**C will be omitted. The process cartridge **105**K may include a drum cartridge including the photosensitive drum **13**K, and the developing cartridge **4**K detachably attached to the drum cartridge.

According to the above described embodiment, the image forming apparatus **1** includes the plurality of levers **33**A and the plurality of levers **33**B. However, in place of the plurality of levers **33**A and the plurality of levers **33**B, a plurality of magnets may be used as long as the drum unit **3** and the belt unit **6** can be connected to each other.

According to the above-described embodiment, the drum unit **3** includes the cam **34**A and the cam **34**B. However, in place of the cam **34**A and the cam **34**B, the drum unit **3** may include a parallel link mechanism as long as the plurality of levers **33**A and the plurality of levers **33**B can be moved.

The drum unit **3** may be movable between an attached position at which the drum unit **3** is attached to the main body casing **2** and a detached position at which the drum unit **3** is completely detached from the main body casing **2**. That is, the drum unit **3** may be movable between the accommodated position and the withdrawn position, and further from the withdrawn position to the detached position. In this case, the accommodated position and the withdrawn position of the drum unit **3** are an example of the attached position.

Similarly, the belt unit **6** may be movable between an attached position at which the belt unit **6** is attached to the main body casing **2** and a detached position at which the belt unit **6** is completely detached from the main body casing **2**. That is, the belt unit **6** may be movable between the accommodated position and the withdrawn position, and further from the withdrawn position to the detached position. In this case, the accommodated position and withdrawn position of the belt unit **6** are an example of the attached position.

What is claimed is:

1. An image forming apparatus comprising:

a main body casing having an opening;

a photosensitive drum;

a support member configured to support the photosensitive drum, the support member being movable through the opening between a first accommodated position and a first withdrawn position, wherein, at the first accommodated position, the support member is accommodated in the main body casing, and wherein, at the first withdrawn position, the support member is withdrawn from the main body casing;

a belt unit movable through the opening between a second accommodated position and a second withdrawn position, wherein, at the second accommodated position, the belt unit is accommodated in the main body casing, and wherein, at the second withdrawn position, the belt unit is withdrawn from the main body casing, the belt unit comprising:

a first sheet guide; and

a transfer belt configured to be in contact with the photosensitive drum in a state where the support member supporting the photosensitive drum is at the first accommodated position and where the belt unit is at the second accommodated position, the belt unit being positioned below the photosensitive drum in a state where the support member supporting the photosensitive drum is at the first accommodated position and where the belt unit is at the second accommodated position, and the belt unit being movable from the second accommodated position to the second withdrawn position together with the support

member in a case where the support member moves from the first accommodated position to the first withdrawn position;

a transfer roller configured to be in contact with an outer surface of the transfer belt in a state where the belt unit is at the second accommodated position; and

a second sheet guide positioned below the belt unit and facing the first sheet guide to define a sheet conveying path between the first sheet guide and the second sheet guide in a state where the belt unit is at the second accommodated position, and the second sheet guide being configured to convey a sheet along the sheet conveying path toward a position between the transfer belt and the transfer roller.

2. The image forming apparatus according to claim **1**, further comprising a connector configured to connect the support member to the belt unit in a case where the support member moves from the first accommodated position to the first withdrawn position.

3. The image forming apparatus according to claim **2**, wherein the connector comprises a lever provided at the support member, the lever being movable between an engagement position and a disengagement position, wherein, at the engagement position, the lever is in engagement with the belt unit, and wherein, at the disengagement position, the lever is out of engagement with the belt unit, and

wherein the belt unit moves from the second accommodated position to the second withdrawn position together with the support member in a state where the lever is at the engagement position.

4. The image forming apparatus according to claim **3**, wherein the support member comprises a first handle configured to move the support member from the first accommodated position to the first withdrawn position, and

wherein the first handle comprises a first grip configured to move the lever from the engagement position to the disengagement position.

5. The image forming apparatus according to claim **4**, wherein the first handle further comprises a second grip facing the first grip,

wherein the first grip is movable relative to the second grip between a first position spaced apart from the second grip and a second position closer to the second grip than the first position is to the second grip, and

wherein the lever moves from the engagement position to the disengagement position in a case where the first grip moves from the first position to the second position.

6. The image forming apparatus according to claim **5**, wherein the support member comprises a link moving in accordance with the movement of the first grip from the first position to the second position, and

wherein the lever moves from the engagement position to the disengagement position in accordance with the movement of the link.

7. The image forming apparatus according to claim **6**, wherein a moving direction of the link is different from a moving direction of the lever.

8. The image forming apparatus according to claim **6**, wherein the link comprises a cam moving together with the first grip in accordance with the movement of the first grip from the first position to the second position, and

wherein the cam has a sloped cam surface capable of contacting the lever.

9. The image forming apparatus according to claim **3**, wherein the support member comprises a spring urging the lever from the disengagement position toward the engagement position.

10. The image forming apparatus according to claim **3**, wherein the photosensitive drum includes a first photosensitive drum, and a second photosensitive drum arrayed with the first photosensitive drum in a first direction,

wherein the support member is configured to support the first photosensitive drum and the second photosensitive drum,

wherein the lever is a first lever, and

wherein the support member further comprises:

a second lever positioned away from the first lever in the first direction, the second lever being movable between an engagement position and a disengagement position, wherein, at the engagement position, the second lever is in engagement with the belt unit, and wherein, at the disengagement position, the second lever is out of engagement with the belt unit; and

a third lever positioned opposite to the first lever and the second lever with respect to the belt unit in an axial direction of the photosensitive drum, the third lever being movable between an engagement position and a disengagement position, wherein, at the engagement position, the third lever is in engagement with the belt unit, and wherein, at the disengagement position the third lever is out of engagement with the belt unit.

11. The image forming apparatus according to claim **3**, wherein the support member comprises:

a first side frame; and

a second side frame positioned opposite to the first side frame with respect to the photosensitive drum in an axial direction of the photosensitive drum,

wherein the first side frame has a first surface facing the second side frame and a second surface opposite to the first surface, and

wherein the lever is positioned at the second surface.

12. The image forming apparatus according to claim **11**, further comprising a waste toner box,

wherein the support member further comprises:

a cleaning blade configured to remove toner from the photosensitive drum; and

a toner conveying tube configured to convey the toner removed by the cleaning blade to the waste toner box, and

wherein the toner conveying tube is provided at the first surface of the first side frame.

13. The image forming apparatus according to claim **1**, wherein the support member further comprises a first handle configured to move the support member from the first accommodated position to the first withdrawn position,

wherein the belt unit further comprises a second handle configured to move the belt unit from the second accommodated position to the second withdrawn position, and

wherein the belt unit is movable together with the support member by the second handle.

14. The image forming apparatus according to claim **1**, further comprising a waste toner box provided at the main body casing,

wherein the belt unit further comprises:

a drive roller configured to drive the transfer belt;

a belt toner conveying tube;

a main frame supporting the drive roller and the belt toner conveying tube;

a driven roller configured to drive the transfer belt in cooperation with the drive roller;

a belt cleaning blade in contact with the transfer belt and configured to remove toner from the transfer belt; and

a sub-frame supporting the driven roller and the belt cleaning blade, the sub-frame being movable relative to the main frame,

wherein the belt toner conveying tube is configured to receive the toner removed by the belt cleaning blade,

wherein the support member further comprises:

a cleaning blade configured to remove toner from the photosensitive drum; and

a toner conveying tube configured to convey the toner removed by the cleaning blade toward the belt toner conveying tube, the toner conveying tube having a first toner discharge opening, and

wherein the belt toner conveying tube has a toner receiving opening and a second toner discharge opening, the toner receiving opening being in communication with the first toner discharge opening of the toner conveying tube in a state where the support member is at the first accommodated position and where the belt unit is at the second accommodated position, the second toner discharge opening being in communication with the waste toner box in a state where the belt unit is at the second accommodated position.

15. The image forming apparatus according to claim **14**, wherein the support member further comprises a shutter movable between an open position opening the first toner discharge opening and a closed position closing the first toner discharge opening, and

wherein the belt unit has a contact surface configured to be in contact with the shutter to move the shutter from the closed position to the open position, in a case where the support member moves from the first withdrawn position to the first accommodated position in a state where the belt unit is at the second accommodated position.

16. The image forming apparatus according to claim **15**, wherein the contact surface maintains contact with the shutter to position the shutter at the open position in a case where the belt unit moves together with the support member from the second accommodated position to the second withdrawn position.

17. The image forming apparatus according to claim **1**, further comprising a waste toner box,

wherein the belt unit further comprises:

a drive roller configured to drive the transfer belt;

a main frame supporting the drive roller;

a driven roller positioned spaced apart from the drive roller in a first direction, the driven roller being configured to drive the transfer belt in cooperation with the drive roller;

a belt cleaning blade in contact with the transfer belt and configured to remove toner from the transfer belt;

an auger screw configured to convey the toner removed by the belt cleaning blade toward the waste toner box; and

a sub-frame supporting the driven roller, the belt cleaning blade, and the auger screw, the sub-frame being movable relative to the main frame in the first direction.

18. The image forming apparatus according to claim **17**, wherein the transfer roller is positioned below the belt unit, the transfer roller being urged toward the transfer belt in a vertical direction, the transfer roller being movable together with the sub-frame in the first direction.

19. The image forming apparatus according to claim **1**, wherein the first sheet guide includes a first sheet conveying roller configured to convey a sheet along the sheet conveying path toward the position between the transfer belt and the transfer roller.

20. The image forming apparatus according to claim **1**, wherein the second sheet guide includes a second sheet conveying roller configured to convey a sheet along the sheet conveying path toward the position between the transfer belt and the transfer roller.

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